Popular Astronomy

Vol. XLIII, No. 9 NOVEMBER, 1935 Whole No. 429

Edwin Brant Frost
1866-1935

By S. A. MITCHELL

Edwin Brant Frost was of old New England stock, the first of the Frost name in the United States having been Edward Frost who came to Boston in 1634. Edwin was the second son of Carleton Pennington Frost (1830-1896) who moved to Hanover, New Hampshire, in 1871 and became a professor in the Dartmouth Medical School and later the dean of the school and a trustee of Dartmouth College.

Edwin graduated from Dartmouth with the bachelor's degree before reaching his twentieth birthday. In 1897, he was appointed instructor in physics and astronomy at Dartmouth and two years later he received the master of arts degree from his alma mater. To those of us who are working in university observatories at the present time, it is difficult to realize that in the early nineties there were so few universities in the United States offering graduate work in astronomy. Virtually the only advanced instruction given in American institutions was in the field of mathematical astronomy and the dissertation offered in partial fulfillment for the higher degree was usually the orbit of a satellite or comet. The few large telescopes in the country were visual refractors devoted largely to measures with the micrometer.

It was a natural and a very wise decision that took Frost to Europe in 1890 for a two-year stay. As he had been born with a fine ear for music, foreign languages came to him quite easily. Hence, after visiting different observatories he went to Potsdam, Germany, to spend his second year abroad. Vogel had established there an observatory devoted principally to astrophysical studies. What a joy it must have been to a young man anxious to do research to live in those days when almost every observation on the stars made with the spectroscope turned out to be a new discovery! The enthusiasm of the director of the Astrophysical Observatory spread to his associates who included Scheiner, Müller, Kempf, Wilsing, Hartmann, Ludendorff, Eberhard, and Lohse.

Frost returned to Dartmouth in 1892 as assistant professor and director of the observatory and three years later he was promoted to full professor when only twenty-nine years old. While he was at Potsdam, Scheiner's *Spectralanalyse der Gestirne* had been published. This was such an important contribution to the new subject of astrophysics that Frost with his excellent knowledge of German made arrangements with Scheiner to bring out an English translation that appeared in 1894. Frost's Scheiner was much more than a translation for the new subject

was growing so rapidly that new methods, results and tables had to be incorporated with the original volume with the consequence that the book remained until quite recently the standard textbook on astrophysics.

In 1895, the young professor might well have thought that he would carry on the family tradition of a happy and prosperous life in New England. The opening of the Yerkes Observatory in 1897 with the largest telescope in the world brought great responsibilities to Professor Hale, then a young man only twenty-nine years old. He himself had already made great contributions to the astrophysics of the sun, especially through the invention, a few years earlier, of the spectroheliograph. With Barnard and Burnham to take care of micrometer work with the great refractor, the reputation of the new observatory was assured. To complete the staff there was needed an astrophysicist to engage in stellar work. Through the generosity of Miss Catherine Wolfe Bruce, Frost was brought to Yerkes in the summer of 1898. The first plan was for him to divide his time between observing at Yerkes and teaching at Dartmouth but in 1902 he resigned his professorship at the latter institution. After the construction of the Bruce spectrograph attached to the 40-inch refracor, it was decided to restrict attention in stellar work to two different types of stars, the "helium" or early type stars and those showing carbon flutings, the red or late type stars; with Hale responsible for the late or M-type stars and Frost for the early or B-type.

My own contacts with Yerkes Observatory antedate those of all but a few astronomers still in active work. Frost and his small family came in the summer of 1898. I arrived in the autumn and remained until the following summer. The winter of 1898-99 was the coldest on record in Williams Bay, for in February the thermometer was zero or below almost every night. It seemed to the budding astronomer, especially after working all night at 26° F below zero, that Hale, Frost, and Snow were appropriate names to find in Wisconsin. Altogether I have spent nearly three years at Yerkes.

It was inspiring to see the manner in which the staff devoted themselves to observing even under the condition of the bitter cold of winter. Mr. Burnham came out from Chicago to work two full nights in succession. Nothing, even a frozen dome at 10° below zero, could curb Mr. Barnard's determination to work. On the spectroscopic program, both during the day with the spectroheliograph and at night with the Bruce spectrograph, the enthusiasm was unbounded. The program on B-type stars undertaken by Frost soon showed that the chances were about one in three that each new spectrum photographed would turn out to be that of a spectroscopic binary. In fact, the interest became so intense that plates were developed as quickly as possible. As Frost was very near-sighted, as soon as the plate was fixed by hypo, he would push up his glasses and examine the photographic spectrum with a magnify-

ing power of ten diameters. Beginning in 1901, he had the enthusiastic collaboration in this work of one of his brilliant Dartmouth students, Walter S. Adams, now director of the Mt. Wilson Observatory.

In addition to his work on early type stars, Frost was a most important contributor to the science of astrophysics through his work as editor of the *Astrophysical Journal*. Founded in 1895 by Hale and Keeler, the *Journal* started off with high standards. Hale went to Mt. Wilson in 1903 on what was thought to be an expedition for solar work. Two years later the expedition became a permanent organization with the result that Frost became the director of Yerkes Observatory. From then until his retirement in 1933, he was mainly responsible for the character of the *Journal*. With his fine knowledge of French and German and his keen appreciation of good English, the reputation of the *Journal* continued to rise higher and ever higher. To have an article accepted for publication, it was not only necessary for the author to make a valuable contribution to the subject but the illustrations had to be of high standard. More than once I have known him to refuse to accept an article from a well-known astrophysicist until the illustrations submitted were returned with adequate neatness.

It has frequently been said by many astronomers that we are a most fortunate group of people in the fact that we are like a large family, the world over, engaged enthusiastically in research for which coöperation is necessary. Following the World War, our brother astronomers in Russia had very difficult times in making ends meet financially or in some cases eking out a bare existence. Frost had been all his life a great admirer of Belopolsky, a leading astrophysicist and one of the collaborators for the *Astrophysical Journal*. Largely through the interest and enthusiasm of Frost, the American astronomers contributed to a fund to be sent through the American Red Cross to assist the Russian astronomers in buying food and clothes. Frost wrote many personal letters with the result that not only were the Russian astronomers tided over a very difficult period but positions were found in American observatories for astronomers from the Soviet Republic.

During the last twenty-five years of his life, the increasing trouble with his eyes which finally culminated in total blindness would have been to most men a tragic handicap. To Mr. Frost it was one more obstacle to be surmounted, a game to be played with gallantry and sportsmanship, that all who came in contact with him marveled at his unwavering cheerfulness. His optimistic temperament caused him to state with great positiveness that the cataract developing on his eye would soon be ripened enough to permit its removal. To those who knew him well, he was a constant inspiration. He had the happy faculty of endearing himself to a very wide circle of friends, both those who were scientists and those who were not. He had a most phenomenal memory for faces and places and took the keenest interest in recalling events that possibly happened thirty years previously. Throughout his life his quick

ear never failed to recognize instantly the voice of a friend, a happy faculty of great service in the later years of failing eyesight.

In September, 1934, my wife and I spent three days in the Frost home. He took me around the observatory which I had known for all but one year of its existence and he pointed out the changes since my last previous visit five years earlier. He took me around the grounds and pointed out the trees and shrubs, all planted under his immediate supervision and with loving care. The Yerkes grounds are quite different now from my early days there when not a tree or shrub was growing. As I had been unable to be present at the celebration in honor of his sixty-fifth birthday, I was privileged to see the letters and testimonials that had come from all over the world. His old Dartmouth students paid tribute to the clear and enthusiastic exposition in the classroom for he was a wonderfully capable teacher with an orderly mind. After he had left New England, his newer friends paid tribute not only to the scientist but to one who truly loved nature in all of its phases but especially in its birds and its flowers. To many, especially in Florida where he went in the winters, he was known as the "blind astronomer." One and all loved him.

In later years, whenever he gave a lecture illustrated by lantern slides the presentation was so clear and the slides appeared on the screen in their appropriate places that it was difficult to realize that he could not see the audience or the screen.

He was honored by election to membership in the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences. He was a foreign associate of the Royal Astronomical Society of Great Britain, and he was an honorary member of the Italian, Mexican, Canadian, and Russian Astronomical Societies. He had honorary degrees from Dartmouth and from Cambridge University.

Mr. Frost found a wonderful helpmeet in his wife, Mary Hazard. They were married in 1896. Their union was blessed by three children, a daughter and two sons.

With the help of his wife, there was published in 1934 *An Astronomer's Life*. It is an enthralling story to read how Edwin and his older brother, Carleton, now a professor in the Harvard Medical School, lived their young lives in a small college community. It is equally enthralling to read of the subsequent years of the astronomer with his hopes and aspirations. One forgets when one reads the book that the author was totally blind. I temporarily forgot, when I saw him in 1932 at the meetings of the International Astronomical Union at Harvard and he described to me the thrills he had experienced from observing the total eclipse of the sun under sky conditions much better than had greeted me in Magog. His impressions given to others are expressed in POPULAR ASTRONOMY, **40**, 474, 1932.

He will be greatly missed by his family and his wide circle of friends.

He will be missed especially by the young who were fortunate enough to come in contact with him on account of the unfailing interest and sound advice he was always ready to extend to those who had yearnings for better things.

LEANDER MCCORMICK OBSERVATORY,
UNIVERSITY, VIRGINIA, OCTOBER 20, 1935.

Calendar Years with Three Lunar Eclipses

By ALEXANDER POGO

In the fifth paper of this series,[1] we have studied the occurrence and recurrence of calendar years with 5 solar and 2 lunar eclipses. A similar study could be made of calendar years with 5 lunar appulses and 2 solar eclipses; two Gregorian years of the 5-appulse type, 1879 and 1944, belonging to a 65-year sequence, are given, as examples, in Table I. This table shows, at a glance, the analogy between the years of the 5-appulse type and the years of the 5-solar type; the central eclipses of the sun in January and in July correspond to the total lunar eclipses in January

TABLE I

CALENDAR YEARS WITH 4 LUNAR APPULSES

1879 Gregorian			1926 Julian			1944 Gregorian		
Jan. 8	appulse	L200				Jan. 10	syzygy	L112
Jan. 22	central	S201	Jan. 1	central	S113	Jan. 25	central	S113
Feb. 7	appulse	L201	Jan. 15	appulse	L113	Feb. 9	appulse	L113
July 3	appulse	L206	June 12	appulse	L118	July 6	appulse	L118
July 19	central	S207	June 26	central	S119	July 20	central	S119
Aug. 2	appulse	L207	July 12	appulse	L119	Aug. 4	appulse	L119
Dec. 28	partial	L212	Dec. 6	appulse	L124	Dec. 29	appulse	L124
			Dec. 21	central	S125			

and July which must occur in a calendar year with 5 solar eclipses; the unobservable early-January penumbral lunar eclipse of 1879 reminds us of the elusive early-January partial solar eclipse of a 5-solar year like 1935; the late-December lunar eclipse is either a small umbral eclipse (as in 1879), analogous to the late-December umbral solar eclipse of a 5-solar year, or a very close appulse (as in 1944). The umbral runs of lunar saros series are represented in the upper half of the cylindrical diagram reproduced in the fourth paper; the 5-solar

[1] The present paper is the sixth of a series dealing with eclipses; see the January, February, April, June-July, and August-September issues of POPULAR ASTRONOMY, Vol. XLIII.

years are located in the regions where the runs of total lunar eclipses overlap with runs of penumbral solar eclipses; similarly, the 5-appulse years belong to the regions where the runs of central solar eclipses would overlap with runs of penumbral lunar eclipses; on the cylindrical diagram reproduced in the third paper, the 5-appulse years would fall on the white descending-spiral lanes.

A further step in the transition from calendar years of the 5-solar type to calendar years of the 3-lunar type is formed by years of the 4-appulse type; the same analogy which exists between the calendar years with either

5 solar eclipses and 2 lunar eclipses
or 2 solar eclipses and 5 lunar appulses,

on the one hand, exists between calendar years with either

3 solar eclipses and 4 lunar appulses
or 4 solar eclipses and 3 lunar eclipses,

on the other. The Julian year 1926 (see Table I) may serve as an example of a year of the 4-appulse type; it is separated by one saros from the Gregorian year 1944, and the two years have six saros series in common.

Penumbral eclipses of the moon will be discussed elsewhere; eclipses of the moon dealt with in the present paper are umbral ones—either total or partial lunar eclipses, not lunar appulses. Since calendar years with 3 umbral eclipses of the moon may contain 4, or 3, or 2 solar

TABLE II

CALENDAR YEARS WITH 3 LUNAR ECLIPSES

Gregorian Calendar			
1787	1852	1917	1982
Jan. 3 t L177 D	Jan. 7 t L89 A	Jan. 8 t L1 D	Jan. 9 t L136 A
Jan. 19 p S178 A	Jan. 21 p S90 D	Jan. 23 p S2 A	Jan. 25 p S137 D
June 15 t S183 D	June 17 p S95 A	June 19 p S7 D	June 21 p S142 A
June 30 t L183 A	July 1 t L95 D	July 4 t L7 A	July 6 t L142 D
July 14 p S184 D	——— S96 A	July 19 p S8 D	July 20 p S143 A
Dec. 9 a S189 A	Dec. 11 t S101 D	Dec. 14 a S13 A	Dec. 15 p S148 D
Dec. 24 p L189 D	Dec. 26 p L101 A	Dec. 28 t L13 D	Dec. 30 t L148 A

Julian Calendar			
1805	1870	1935	2000
Jan. 3 t L177 D	Jan. 5 t L89 A	Jan. 6 t L1 D	Jan. 8 t L136 A
Jan. 18 p S178 A	Jan. 19 p S90 D	Jan. 21 p S2 A	Jan. 23 p S137 D
June 14 p S183 D	June 16 p S95 A	June 17 p S7 D	June 18 p S142 A
June 29 t L183 A	June 30 t L95 D	July 3 t L7 A	July 3 t L142 D
July 14 p S184 D	July 16 p S96 A	July 17 p S8 D	July 18 p S143 A
Dec. 9 a S189 A	Dec. 10 t S101 D	Dec. 12 a S13 A	Dec. 12 p S148 D
Dec. 24 p L189 D	Dec. 25 p L101 A	Dec. 26 t L13 D	Dec. 27 t L148 A

eclipses, we must distinguish between the special case of the occurrence of calendar years with 7 eclipses and the more general problem of the periodicity of calendar years with 3 lunar eclipses.

Let us begin with the current 7-eclipse year, 1935,—a year with 5 solar eclipses in the Gregorian calendar (see Table I of the fifth paper), and a year with 3 lunar eclipses in the Julian calendar (see Table II of the present paper). The six eclipses belonging to the saros series L1, S2, S7, L7, S8, and S13, are common both to the Gregorian and to the Julian 7-eclipse year; the early-January solar eclipse belonging to series S1, on the one hand, and the late-December eclipse belonging to series L13, on the other, complete the two sets of 7 eclipses. If we compare the 7 eclipses of the Julian calendar year 1935 with the 7 eclipses of the Gregorian calendar year 1917, we see that they belong to the same group of 7 saros series. An inspection of the two tables reveals, therefore, the importance of the saros as a link between 3-lunar and 5-solar years belonging to the same calendar (*e.g.* 1787 and 1805 Gregorian), or as a link between 3-lunar years belonging to different calendars (*e.g.* 1852 Gregorian and 1870 Julian). It ought to be noticed that, in a 3-lunar year, the June and December eclipses of the sun may be either umbral or penumbral, and that the December eclipse of the moon may be either total or partial; the independence of a 3-lunar year from the elusive early-January solar eclipse is an additional reason for the relatively frequent occurrence of this rugged type of 7-eclipse years.

The role played by the Metonic cycle in the recurrence of calendar years with 3 lunar eclipses does not depend on the changing number of days separating corresponding Julian and Gregorian dates. Table IV shows that 235 lunations differ, on the average, by less than one-tenth of one day from either 19 Julian or from 19 Gregorian years; two

TABLE III

THE METONIC CYCLE AND CALENDAR YEARS WITH 3 LUNAR ECLIPSES

1768 Gregorian			1786 Julian			1787 Gregorian			1805 Julian		
Jan. 4	p	L165	Jan. 3	p	L165	Jan. 3	t	L177	Jan. 3	t	L177
Jan. 19	at	S166	Jan. 19	at	S166	Jan. 19	p	S178	Jan. 18	p	L178
		S171			S171						
June 30	t	L171	June 30	t	L171	June 15	t	S183	June 14	p	S183
July 14	t	S172	July 14	t	S172	June 30	t	L183	June 29	t	L183
						July 14	p	S184	July 14	p	S184
Dec. 9	p	S177	Dec. 9	p	S177						
Dec. 23	t	L177	Dec. 23	t	L177	Dec. 9	a	S189	Dec. 9	a	S189
						Dec. 24	p	L189	Dec. 24	p	L189

eclipses separated by a Metonic cycle fall, therefore, on about the same date. Lunar or solar eclipses separated by 235 lunations or 19 years may be joined, on a cylindrical diagram of lunar or solar saros series, by a move of the chess knight: one step to the next winding corresponds to 223 lunations or 18 years and 10 days, while a double step in the direction of successive eclipses of a winding corresponds to 1 year less 10 days. Table III illustrates the importance of the Metonic cycle in the case of calendar years with 3 lunar eclipses. The corresponding eclipses of the Gregorian years 1768 and 1787 are separated by a Metonic cycle; they belong to two consecutive windings of our spirals, and represent a shift of two eclipse seasons in the direction of the windings; the early-January eclipse of 1787 is separated by a Metonic cycle from the early-January eclipse of 1768, and by a saros from the late-December eclipse of 1768. Similarly, the corresponding eclipses of the Julian years, 1786

TABLE IV

ECLIPSE CYCLES

Months:	Metonic Cycle d	456 years (166552.5 days) d	521 years (190295.1 days) d
Synodical	×235 = 6939.69	×5640 = 166552.52	×6444 = 190295.11
Nodical	×255 = 6939.12	×6120½ = 166552.39	×6993 = 190295.05
Anomalistic	×252 = 6943.75	×6044½ = 166553.48	×6906 = 190291.72
Tropical	×254 = 6939.68	×6096 = 166552.36	×6965 = 190294.82
Sidereal	×254 = 6939.70	×6096 = 166552.85	×6965 = 190295.37
Years:			
Ecl. (500 B.C.)	×20 = 6932.39	×480½ = 166550.55	×549 = 190293.97
Ecl. (A.D. 1500)	×20 = 6932.40	×480½ = 166550.86	×549 = 190294.33
Julian	×19 = 6939.75	×456 = 166554.00	×521 = 190295.25
Gregorian	×19 = 6939.61	×456 = 166550.58	×521 = 190291.34
Trop. (500 B.C.)	×19 = 6939.60	×456 = 166550.51	×521 = 190291.26
Trop. (A.D. 1500)	×19 = 6939.60	×456 = 166550.45	×521 = 190291.20
Sidereal	×19 = 6939.87	×456 = 166556.90	×521 = 190298.56

and 1805, belong to the same group of saros series, and may be joined by a move of the chess knight; the late-December eclipse of 1786 Julian is, of course, identical with the early-January eclipse of 1787 Gregorian. Figures 1 and 2 offer numerous examples of Metonic couples of calendar years with 3 lunar eclipses.

A glance at Table II shows the fundamental importance of the 65-year sequences in the periodicity of calendar years with 3 lunar eclipses. Two examples of 65-year sequences of lunar eclipses are given in Table V; it will be noticed that appulses may occur, at the beginning or at the end of such sequences, among the small partial eclipses; the dates of eclipses separated by 23742 or 23743 days advance faster in the Gregorian than in the Julian calendar. The group of 8 late-December lunar eclipses of the Julian 65-year sequence of Table V, and the group of 8 early-January eclipses of the same sequence belong to two consecutive spiral windings of the cylindrical diagram reproduced in Figure 1; the last December eclipse and the first January eclipse of the 65-year sequence belong to two calendar years, 1088 and 1154, whose early-

TABLE V

65-YEAR SEQUENCES OF LUNAR ECLIPSES

Julian Calendar	Magn.	Saros Series	Node	Gregorian Calendar	Magn.	Saros Series	Node
308 Dec. 14	0.4	L182	A	876 Dec. 9	0.4	L71	D
373 Dec. 16	0.4	94	D	(941 Dec. 11	app.	206	A)
438 Dec. 17	0.9	6	A	1006 Dec. 13	3.2	118	D
503 Dec. 19	5.2	141	D	1071 Dec. 15	5.1	30	A
568 Dec. 20	5.1	53	A	1136 Dec. 17	3.9	165	D
				1201 Dec. 18	8.5	77	A
633 Dec. 21	6.6	188	D	1266 Dec. 20	9.6	212	D
698 Dec. 22	10.3	100	A				
763 Dec. 25	9.7	12	D	1331 Dec. 23	9.7	124	A
828 Dec. 25	12.2	147	A	1396 Dec. 23	13.8	36	D
893 Dec. 26	15.1	59	D	1461 Dec. 26	14.5	171	A
958 Dec. 28	14.7	194	A	1526 Dec. 28	15.4	83	D
1023 Dec. 29	17.9	106	D	1591 Dec. 30	18.8	218	A
1088 Dec. 30	19.8	18	A	1656 Dec. 31	19.4	130	D
1154 Jan. 1	19.8	153	D	1722 Jan. 2	21.4	42	A
1219 Jan. 2	20.5	65	A	1787 Jan. 3	21.1	177	D
1284 Jan. 4	20.5	200	D	1852 Jan. 7	20.2	89	A
1349 Jan. 5	18.7	112	A	1917 Jan. 8	16.4	1	D
1414 Jan. 6	15.0	24	D	1982 Jan. 9	16.2	136	A
1479 Jan. 8	15.6	159	A	2047 Jan. 12	14.6	48	D
1544 Jan. 10	13.0	71	D				
1609 Jan. 10	9.8	206	A	2112 Jan. 14	10.6	183	A
				2177 Jan. 14	p	95	D
1674 Jan. 12	10.6	118	D	2242 Jan. 17	p	L7	A
1739 Jan. 13	7.3	30	A		etc		
1804 Jan. 14	4.7	165	D				
1869 Jan. 16	5.6	77	A				
1934 Jan. 17	1.4	212	D				
(1999 Jan. 18	app.	124	A)				
2064 Jan. 20	0.5	L36	D				

January eclipses, on the one hand, and late-December eclipses, on the other, are separated by 66 years, respectively; hence the 66-year interval between the 521-year diagonal sequence of the Julian years

—996, —475, 46, 567, 1088, and 1609,

characterized by the 3rd lunar eclipse on December 30 or 31, and the 521-year diagonal sequence of the Julian years

—930, —409, 112, 633, 1154, and 1675,

beginning with lunar eclipses on January 1.

Similarly, the group of 6 late-December lunar eclipses and the group of 6 early-January eclipses of the Gregorian 65-year sequence of Table V belong to two consecutive spiral windings of the cylindrical diagram reproduced in Figure 2; there is, therefore, a 66-year interval between the 391-year diagonal passing through the Gregorian years 1265 and 1656, characterized by lunar eclipses on December 31, and the 391-year diagonal sequence formed by the Gregorian years 158, 549, 940, 1331, 1722, and 2113, characterized by lunar eclipses on January 2.

The periods of 521 years and of 391 years, mentioned in the two preceding paragraphs, are intimately connected with the 65-year eclipse

sequences in the Julian and the Gregorian calendars, respectively. The period of 521 years was discussed in the fifth paper, where it was pointed out that eclipses separated by 190295 days fall, in the Julian calendar, not only on about the same date, but also on the same day of the week; in the Gregorian calendar, the role of the 521-year period is limited, as far as years with 7 eclipses are concerned; Table IV of the present paper gives the "multiplication table" of this period, for future reference. In the case of the Gregorian calendar, a period of 391 years separates ecliptic syzygies falling on about the same date: the difference be-

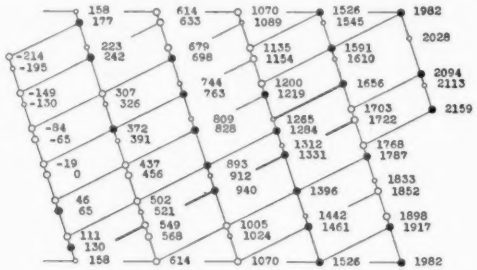


FIGURE 1.

JULIAN CALENDAR YEARS WITH 3 LUNAR ECLIPSES.

Dots represent years with 3 lunar and 4 solar eclipses
Large circles, " " 3 " " 3 " "
Small " " " 3 " " 2 " "

tween 4836 lunations and 391 Gregorian years amounts to a few hours; in the case of the Julian calendar, the difference between 391 years and 4836 lunations amounts to almost three days, and the role of the 391-

TABLE VI

ECLIPSE SEQUENCES

391 years (142810 days)

Julian Calendar		Gregorian Calendar			
—345 July 10	2.3	J.D. 1571494	—410 July 3	6.4	L216	A
46 July 6	7.8	1714304	—19 July 3	11.8	146	A
437 July 3	15.3	1857114	372 July 3	16.6	76	A
828 July 1	21.9	1999924	763 July 4	22.3	6	A
1219 June 29	16.9	2142734	1154 July 4	16.6	159	A
1610 June 26	10.2	2285544	1545 July 4	10.8	89	A
2001 June 22	6.2	2428354	1936 July 4	3.4	L19	A

456 years (166552.5 days)

Julian Calendar					Gregorian Calendar				
—996 Dec. 16	p	S110	D		—819 Dec. 16	12.5	L69	D
—540 Dec. 14	p	175	A		—363 Dec. 18	17.7	134	A
—84 Dec. 13	p	17	D		93 Dec. 19	19.7	199	D
372 Dec. 11	p	82	A		549 Dec. 22	20.8	41	A
828 Dec. 10	t	147	D		1005 Dec. 24	17.7	106	D
1284 Dec. 8	a	212	A		1461 Dec. 26	14.5	171	A
1740 Dec. 7	a	S54	D		1917 Dec. 28	12.3	L13	D

Binder: Please insert this slip between the pages 554 and 555, below the illustrations.

The two cuts have been interchanged in the page proofs.
The diagram printed on p. 555 is Fig. 1 (Julian network).
The diagram printed on p. 554 is Fig. 2 (Gregorian network).

year period is, therefore, negligible, as far as 7-eclipse years are concerned. Table VI offers an example of a rapidly receding Julian 391-year sequence and an example of a "dated" sequence of lunar eclipses separated by 142810 days, occurring at the ascending node, and falling on July 3 or 4, in the Gregorian calendar. On a cylindrical diagram of saros series, eclipses belonging to a 391-year sequence fall on steeply ascending spirals, and are separated by 22 saroses less 70 lunations.

The importance of the 586-year period, in the case of Julian calendar years with 7 eclipses, was dealt with in the fifth paper. We may, there-

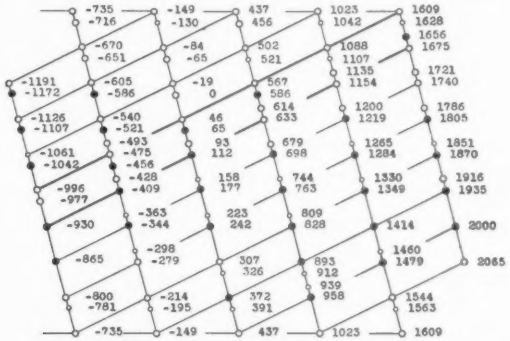


FIGURE 2.

GREGORIAN CALENDAR YEARS WITH 3 LUNAR ECLIPSES.

Dots represent years with 3 lunar and 4 solar eclipses
Large circles, " " 3 " " 3 " "
Small " " " 3 " " 2 " "

fore, limit our discussion of the periods resulting from the combination of the descending-spiral 65-year period with the ascending-spiral periods of 521 and 391 years, to the case of the abscissae of the Gregorian diagram reproduced in Figure 2. The hexa-Callippic cycle of 456 years corresponds to 6 Callippic cycles of 76 years or to 24 Metonic cycles of 19 years. Table IV shows that 456 Julian years exceed 5640 lunations by about 1½ days, while 5640 lunations exceed 456 Gregorian years by about 2 days; the hexa-Callippic cycle could, therefore, be used with about the same degree of success in both calendars; in the case of the Julian calendar, however, the slowly progressing dates corresponding to the 586-year period give more satisfactory results than the slowly receding dates of the 456-year sequence; in the case of the Gregorian calendar, the hexa-Callippic cycle plays a role comparable to that of the 586-year period in the Julian calendar. Table VI offers an example of the gradual recession, in the Julian calendar, of the dates of solar eclipses separated by 166552.5 days, and an example of the gradual advance, in the Gregorian calendar, of the dates of lunar eclipses belonging to a hexa-Callippic sequence. On a cylindrical diagram of saros

series, eclipses occurring at intervals of 456 years belong to steeply descending spirals, and are separated by 25 saros windings in the direction of the abscissae, and by 65 lunations in the direction of the ordinates.

After this survey of the periods contributing to the recurrence of calendar years with 3 lunar eclipses, we are ready to inspect the patterns formed by these years on the diagrams of Figures 1 and 2. We shall assume, as we did in the fifth paper, that such a diagram is formed by winding an "eclipse string" around a horizontal cylinder of an appropriate diameter; the successive years with 3 lunar eclipses are represented, on the string, by knots or beads; in the case of the "Julian string," the pitch of the windings, on the horizontal cylinder, corresponds to 586 years; in the case of the "Gregorian string," the pitch of the windings corresponds to 456 years. The "Julian string" could be wound around other cylinders, in spirals corresponding, for instance, to 651, or 521, or 456 years; in order to make Figure 1 of the present paper comparable with the two cylindrical diagrams reproduced in the fifth paper, the period of 586 years was chosen as the pitch of the spiral windings of the "Julian string"; these three cylindrical diagrams were cut along the generatrix (top and bottom) corresponding to the years —735, —149, 437, 1023, and 1609; the ascending-spiral 66-year lane ends, therefore, in the right upper corner of the diagram of Figure 1. If the "Julian string" of 3-lunar years were wound around a horizontal cylinder in such a manner that the pitch of the windings should correspond to 521 years, the 66-year lane would become horizontal, the 456-year sequences would form ascending spirals, the 586-year sequences would form descending spirals, and the 7-eclipse years of three millennia would form two descending-spiral groups regardless of the choice of the 521-year sequence appearing at the top and at the bottom of the diagram.

The networks of the diagrams reproduced in Figures 1 and 2 illustrate the analogy between the roles played by the periods of 586 and 456 years, and by the periods of 521 and 391 years, in the Julian and in the Gregorian calendars, respectively. The next Julian year with 3 lunar and 4 solar eclipses will be 2000, separated by 586 years from 1414, by 521 years from 1479, and by 65 years from 1935. The next Gregorian year with 3 lunar and 4 solar eclipses will be 1982, connected by the periods of 456, 391, and 65 years with the 7-eclipse years 1526, 1591, and 1917, respectively.

The following remark is made here in order to preclude the possibility of the use of the present paper as a basis for speculations in the *genre* of H. Grattan Guinness, D.D., F.R.A.S. Since the astronomical zero year of the Christian era, *i.e.* the year 1 B.C. of the historians, happened to be a year with 3 lunar eclipses, the various periods mentioned in the present paper, and in the previous one, are represented by the following Julian years with 5 solar or with 3 lunar eclipses: 18, —19, —65 and 65, 326, 391, —456 and 456, —521 and 521, —568, —586 and 586,

—651, and 1172. A similar "radiation" of the periods from the zero year would, of course, exist, if the zero year happened to coincide with the years —19 or 46. There is 1 chance in 22 that a year chosen at random between 20 B.C. and A.D. 46, will be a year with 3 lunar eclipses.

CARNEGIE INSTITUTION OF WASHINGTON,
April 20, 1935.

Shall we see the Leonids this November?

By WILLIAM H. PICKERING

For reasons which will appear shortly there was little reason to expect to see the Leonids in great numbers before the present year. Indeed I stated in POPULAR ASTRONOMY as far back as in 1899, **7**, 523, and also since then,* that I did not expect them until 1935. This year, however, there is perhaps as much as an even chance that something may be seen somewhere on the civilized portion of our globe. How much, depends, partly, on how deeply we penetrate into the spindle shaped body that we believe will lie between us and the sun and which we call the meteor swarm and, partly, on what portion of our earth is visited by the swarm, for there is considerable evidence to indicate that the diameter of the spindle is appreciably less than that of the earth. Thus in 1901 no shower was detected in our northern states, although it was very marked in the West Indies, in our southwestern states, and in Mexico. Again there were well pronounced showers in the two previous centuries in portions of Arabia and South America which were not even suspected in Europe or the United States. It is noticeable that great showers are generally observed in low latitudes, due doubtless to the strong terrestrial perturbation. The Leonids, which form a discarded portion of the comet of 1866 I, are now spread along their orbit so far that it would require three years for them to pass a given point in it.

In 1898 a very satisfactory shower had been observed in our northeastern states, although not comparable to the early ones of the century. It was therefore generally expected that in the following year a really great shower might be seen. Great was the disappointment therefore to astronomers as well as to the laity when nothing of any consequence was visible. About this time a paper was published by Messrs. Stoney and Downing pointing out the probability that owing to perturbations due to Jupiter and Saturn the center of the meteor swarm must have lain 1,300,000 miles inside of the orbit of the earth. Olivier has pointed out, however, that when the head of the swarm arrived in 1898, Jupiter was not near enough to have affected it materially, and, when the end of the tail arrived, Jupiter was again too far away, having passed the swarm by that time. It was only when the swarm was most favorably placed that Jupiter acted, and drew it away from the earth and towards the sun.

*POPULAR ASTRONOMY, 1902, **10**, 8, and 1933, **41**, 22.

This clearly explains the fact, at least qualitatively, that we should have had two fairly good displays of meteoric showers in 1898 and 1901, and practically nothing at all in 1899 and 1900. The display of 1901 indeed was probably the best of the four.

Table I is an abridgment of the one prepared by Professor H. A. Newton giving the dates of the return of the meteors from their first known appearance in 902 through the great shower of 1833. From it Newton deduced the period of 33.25 years. This period is still in use by many astronomers, although it is clear that to obtain the present period the later observations only should be employed. In the second

TABLE I

THE LEONIDS

Appearance	Diff.	Period	Appearance	Diff.	Period
902			1366		
	29	29		167	33
931			1533		
	32	32		69	34
934			1602		
	68	34		96	32
1002			1698		
	99	33		101	34
1101			1799		
	101	34		34	34
1202			1833		
	164	33			
1366					

column of the table are given the differences of those in the first, and in the third column these differences are divided by such factors as will give periods analogous to those of the present time. That the differences in the numbers in this last column represent real facts, and not accidental errors, is obvious when we recall that all comets which have appeared as much as three times have varying periods. Thus the periods of Halley's comet range from 74 to 79 years.

In Table II the first column gives the dates of the returns for the last 240 years. This limit was selected because during that interval the periods are very uniform indicating that there was comparatively little

TABLE II

THE LEONIDS

O	C	O—C	O	C	O—C
1698	1697	+1	1833	1833	0
—	1731	—	1867	1867	0
—	1765	—	1901	1901	0
1799	1799	0	1935?	1935	0?

tangential perturbation of the swarm, while before it they are not only very irregular, but much longer intervals between the observations occur. The last date is obviously at present indeterminate. The second column gives the computed dates, after subtracting one year from the first number, by simply adding 34 years to each succeeding date in the

second column. It appears to me that fractions of a year are unsuited to the present problem, as suggesting greater accuracy of knowledge than really exists, without computing planetary perturbations, but the average of the six known periods is 33.8 years. It is now very certain that we shall have only one maximum year at this return unless some small maximum occurred in 1932. It will be seen that Olivier's method, which may locate the end of the stream, and mine which locates the middle besides lengthening the period, are not compatible with one another, but they both lead to the same result,—that there should be an exhibition of Leonids this year.

PRIVATE OBSERVATORY, MANDEVILLE, JAMAICA, B. W. I., SEPTEMBER 25, 1935.

Some New Trends in Stellar Spectroscopy

By OTTO STRUVE

(Continued from page 496.)

STARK EFFECT

We have seen that axial rotation accounts satisfactorily for a number of phenomena observed in stars of group one. However, a minute examination of spectra of B-type stars reveals cases of line broadening which are not accounted for by this theory. Consider, for example, the star γ Pegasi, of spectral class B2. The lines are in general narrow with the exception, of course, of the Balmer lines, which are broad and diffuse. But the hydrogen lines are considered in group two of our observational data. If we examine carefully the lines of Si III, O II, N II, etc., we find that their widths are as narrow as can be obtained with any stellar spectrograph now in existence. Plates taken with a dispersion of 5 angstroms per millimeter at the Coudé focus of the 100-inch telescope at Mount Wilson show that the true line widths must be below the resolving power of the instrument. When we examine the helium lines of γ Pegasi we find that some of them are also sharp and narrow, for example, $\lambda\lambda$ 3965, 4121, 4169. However, other lines of helium, for example, $\lambda\lambda$ 3872, 3927, 4009, 4026, 4388, 4472, are appreciably broadened and have diffuse edges.

Since rotational broadening must affect all lines in a star's spectrum, a different explanation must be looked for in the case of these helium lines. Furthermore, Doppler effect produces line widths which are proportional to the wave-lengths. In the helium lines, on the contrary, the broadening seems to increase toward the violet. For example, λ 3872 is much broader than λ 4922 of the same spectral series. An examination of the helium lines which are subject to broadening in such stars as γ Pegasi, δ Ceti, and γ Orionis, reveals the interesting fact that all of them belong to two spectral series: $2^3P - n^3D$ and $2^1P - n^1D$. All

members of the other helium series are sharp. The two series having broadened lines are characteristically designated as the diffuse series of helium triplets and the diffuse series of singlets. These names, assigned long ago on the basis of laboratory experiments, suggest that even in the discharge tube these lines have a tendency to be broad and diffuse. Accordingly, we are justified in turning to physics for an appropriate explanation of the observed effects. These have been found to be the result of inter-ionic Stark effect produced between charged particles and helium atoms. The helium lines of the two diffuse series are easily split into a number of components if the vapor is kept in an electric field. This phenomenon was discovered in the laboratory by J. Stark in 1913 and has since been carefully investigated by a number of physicists. The most complete laboratory investigation of the Stark effect in helium is that of J. S. Foster of McGill University.

In the atmospheres of the stars the gases are known to be highly ionized. From a study of their spectral lines we find that most atoms have lost at least one electron and many have lost two, three, or even more. All of these free electrons are moving about in the gas and each is charged with a minute quantity of negative electricity equal to 5×10^{-10} electrostatic unit. The remaining ions contain equal amounts of positive electricity. Now suppose that in its flight through the atmosphere of a star such a charged particle, ion or electron, happens to pass near a helium atom that is about to radiate the line 4472. Naturally the electric charge will cause perturbations in the electronic orbits of the radiating atom and the emitted line should display the characteristic features of the Stark effect. The motions of the atoms, ions, and electrons are distributed at random. Consequently, some atoms will be under the influence of nearby charged particles, while other atoms will be relatively free of disturbing effects. The observed appearance of a spectral line in such a gas must, therefore, correspond to the superposition of a large number of individual Stark patterns. The line will appear broadened and the amount of broadening will depend upon the average distance between atoms and charged particles.

Physicists have shown theoretically that only the lines of the diffuse series in helium are subject to a large Stark effect. In the other lines the Stark effect can be observed only when the electric fields are enormously high. The average distance between the charged particles and an atom must naturally depend upon the pressure of the gas, and this is again related to the surface gravity. Now the surface gravity of a dwarf star is much greater than that of a giant. Accordingly, if our explanation is correct, Stark broadening should display a correlation with absolute magnitude. Such a correlation actually exists: γ Pegasi, δ Ceti, and γ Orionis are all comparatively faint stars; the more luminous B stars, such as 67 Ophiuchi, ϵ Canis Majoris, and ζ Persei do not show broadening in the diffuse helium lines.

Stark discovered another important phenomenon produced by electric

fields. When an atom radiates in the presence of such a field, the ordinary selection principles of the quantum theory are violated and transitions between spectral terms are observed which are not present in ordinary spectra. In the case of helium the violation of selection rules is confined largely to the choice of azimuthal quantum numbers. Under ordinary circumstances the azimuthal quantum number must change by one unit. Transitions corresponding to no change or to a change greater than one are forbidden. For example, the line 4472 involves a change from state ^{3}P to state ^{3}D. The corresponding transition from state ^{3}P to state ^{3}F is forbidden. Were it permitted, a line would be observed at λ 4470, in the immediate vicinity of the permitted line 4472. The two terms, 4^3D and 4^3F differ very slightly and therefore the difference in wave-length between the permitted and the forbidden line is only two angstroms. The forbidden line was observed by Stark and was found by him and by others to occur in relatively weak electric fields. In γ Pegasi and in other B-type dwarfs a line at λ 4470 is actually observed and, similarly, other forbidden lines of helium are found in the vicinity of helium $\lambda\lambda$ 4026, 4388, and 4922. The wave-length of the forbidden line agrees exactly with that computed, from laboratory experiments, for rather weak electric fields. If there is any discrepancy between theory and observation it is in the surprisingly great intensity of the stellar forbidden lines. Foster and Douglas have recently shown that it is difficult to reconcile the intensities, even allowing for the fact that absorption lines, especially those in the reversing layers of the stars, show less difference in intensity than do the corresponding emission lines.

We agree with Foster and Douglas that the average electric field computed from the broadening of the diffuse lines would not be expected to produce as strong a forbidden line as λ 4470 with as little violet shift as has actually been observed in several stars. There is probably no reason to suspect that anything is wrong with the theory of Stark effect in stellar atmospheres, but it is quite possible that other causes tend to overthrow selection rules and that, consequently, λ 4470 can appear at lower average electric fields than we have heretofore considered probable. A rough computation shows that the average field in a stellar atmosphere produced by the ions is between 1000 and 10,000 volts per centimeter. Such a field would not be considered strong from the laboratory point of view, where fields of several hundred thousand volts per centimeter are produced. Knowing the average field intensity in a stellar atmosphere we can compute the pressure of the gas. The result is in entire agreement with Russell's value for the average pressure in a stellar atmosphere.

It is evident that the Stark effect can be used to discriminate between stars of high and low luminosity. This method has been successfully used for a number of stars, but in practice it is limited by the fact that rotationally broadened lines fail to show the minor broadening of the diffuse helium lines.

Our results concerning Stark effect in helium lines bring us naturally to the consideration of those stars which we included in our group two. These are characterized by extremely wide Balmer lines of hydrogen. They belong to spectral classes B, A, and F and show a marked variation for different stars. For example, Vega has hydrogen lines which are several hundred angstroms wide, while α Cygni, of approximately the same spectral class, has narrow and sharp lines. This effect is evidently related to absolute magnitude: Vega is not very luminous, while α Cygni is a typical supergiant. The broadening of the hydrogen lines has for a number of years been tentatively attributed to Stark effect. Hulburt, Vasnecov, and especially Russell and Stewart, have made computations showing that under the pressures believed to exist in stellar atmospheres, broadening of the Balmer lines should be observable. Our results for the helium lines strengthen this belief. Since there are no lines in hydrogen devoid of Stark effect and since there are no forbidden lines of hydrogen which make their appearance in electric fields it is impossible to make as convincing a test as was made in the case of helium. The observational evidence is therefore limited to the contours of the Balmer lines. These have been investigated at the Yerkes Observatory and the results have been found to be in fair agreement with the requirements of the theory.

The Stark patterns in hydrogen are always symmetrical. Thus Hβ, if produced in an electric field, splits into two stronger and many fainter components. For Hγ the number of strong components is four. A charge equal to one unit on the electrostatic system, placed at a distance of one centimeter from the radiating gas, will displace the outermost components of the Hβ line by an amount equal to 0.06 angstrom.

In a paper published some years ago by Elvey and the writer a computation was carried out to determine the theoretical contour of a hydrogen line broadened by Stark effect. The assumption was made that the line Hγ if devoid of Stark effect would have the same shape as that observed in the giant star η Leonis. It was next assumed that the pressure in the atmosphere of the star varies in accordance with a formula suggested by Milne. For different layers in the star's atmosphere having different pressures, the corresponding mean electric fields were then computed and the average Stark pattern was determined for Hγ. The assumption was next made, in agreement with the work of Unsöld, that the electrons and atoms are distributed at random, and the corresponding effect of broadening was computed for each layer. The combined absorption of all layers was then determined with the help of an equation derived by Eddington. The result shows what would happen to the Hγ line of η Leonis if it were subjected to conditions believed to exist in ordinary dwarf stars. The results are distinctly encouraging and agree in general with the observations: Normal pressures produce appreciable modifications in the contour of Hγ. The total absorptions of the hydrogen lines are greatly increased by the Stark effect and the

general contour of the computed lines bears a marked resemblance to the observed contours in dwarf stars like γ Pegasi.

Since the Stark effect in hydrogen increases with the serial number we should expect that the total absorptions of successive members of the Balmer series would not decline as rapidly as do the intensities of emission lines in laboratory spectra. In fact we may even have an increase in total absorption as we approach the limit of the Balmer series. This is one of the outstanding characteristics of the observational results in all stellar hydrogen lines. Furthermore, our computations show that the spread of the wings must be much greater in the dwarfs than in the giants and, accordingly, there should be an absolute-magnitude effect for hydrogen. While all major characteristics of the observed contours are satisfactorily accounted for, there emerge from a detailed study certain results which indicate the presence of other unknown effects. For example it was found that the observed contour of Hδ in the spectrum of the dwarf ι Herculis can not be produced by Stark effect from the observed contour of the same line in the giant 67 Ophiuchi. These two stars are of approximately the same type and there is no obvious reason why the theory should not apply. Apparently the hydrogen lines are subject to an additional absolute-magnitude effect, the nature of which can not now be determined. On the other hand, if we compare the observed contours in ϵ Aurigae, a well-known supergiant, with those in γ Pegasi, a typical dwarf, we find that the theoretical prediction is well supported.

Before we leave the subject of the hydrogen lines, attention must be called to the fact that the existence of Stark broadening in hydrogen and helium may appreciably alter results based upon the theory of ionization. It is not permissible to consider the total intensities or the central intensities of the hydrogen lines as functions of numbers of atoms alone. The Stark effect must increase with temperature, and the total absorptions of the hydrogen lines will therefore be increased in the direction of the hotter stars, thereby producing a systematic departure from the theoretical curves given by the ordinary ionization formulae.

The only other atom that is subject to a pronounced Stark effect is that of ionized helium. In the O-type stars such as 10 Lacertae, a number of He II lines have been measured and the broadening of λ 4200 is clearly seen on the plates. Accurate contours of the He II lines have not been observed, but rough measurements of line widths have been tested theoretically and have been found to be in agreement with theory. It is of considerable interest to compare the Stark effect for members of the Fowler series with that for members of the Pickering series. The theory of the Stark effect suggests that the lines 4200 and 4542 should show a much greater width than λ 4686. This seems to be in accordance with expectation. A comparison can also be made between the Balmer lines and the Fowler lines of He II. Theoretically,

the Stark broadening of the Fowler lines should exceed that of Hε and would be equalled only by the broadening in the higher members of the Balmer series where blending and confluence of the wings would make it impossible to study the contours in detail. In actual practice the Balmer lines are so much stronger than the He II lines that a qualitative comparison is useless. However, it seems quite consistent with the observations to say that the Fowler lines are relatively broader than the corresponding hydrogen lines of the same total intensity. The broadening of the He II lines should, of course, also be sensitive to differences in absolute magnitude. The observational data are limited to very few stars, but a comparison of the giant 9 Camelopardalis with the dwarf 10 Lacertae indicates that this effect is present. The broadening of the Fowler series has been observed in the laboratory by Paschen, whose work was limited to the extreme ultra-violet part of the spectrum. The broadening of the Pickering lines 4542 and 4200 seems not to have been observed in the laboratory.

Natural Width

We now turn to the third group of stars, namely those of late class, in which the lines of Ca II are strong and broad. The correct explanation of these line widths was first given by Russell, who showed that all strong lines in the atmospheres of the sun and stars are "winged." In a far-reaching investigation Unsöld, in 1927, combined the theory of radiation damping with that of a stellar atmosphere. It is difficult to understand why this theory, well known to physicists twenty or more years ago had failed to make an impression in astrophysics prior to the work of Unsöld. The explanation may perhaps be the misleading statement, often found in text books, that the natural width of a line is a minute fraction of one angstrom (0.000116A) and is, therefore, below the resolving power of any stellar spectrograph. What was overlooked in this statement was the difference between emission and absorption lines. The natural width of a line defined, let us say, as the width measured at an ordinate one-half the maximum intensity, is constant for any given emission line no matter how long the exposure. If we have a faint emission line the central intensity is small and the line width is measured at a low value of the intensity .If we increase the exposure, we thereby increase the maximum intensity and the line width is measured at a greater intensity. Were our measurements confined to a constant value of the intensity or plate blackening, the width of the emission line would, of course, increase in agreement with the factor $(\lambda - \lambda_0)^2$ in the emission coefficient. In practice such measurements would be hopeless because the over-exposure of the central portions of the line would cause spurious photographic effects. It is clear, therefore, that natural line widths can not be measured in emission lines photographed with stellar spectrographs. Conditions are entirely different if we consider an absorption line. Radiation damping causes such a line to be intense in the middle, where almost all the light of the continuous

spectrum is removed. The wings extend toward the red and toward the violet, in accordance with the term $(\lambda - \lambda_0)^2$. For a very weak line the width measured, let us say, at a point where the absorption is 0.5, would be so small as to be below the resolving power of the instrument. For a stronger line the central absorption increases but slightly since it can never exceed the value of 1.0. The wings, however, spread out in proportion to the square root of the total number of atoms present in the absorption chamber. Accordingly, our line width will increase as the square root of N and can be made as large as is desired. Minkowski at Hamburg, Stewart and his associates at Princeton, and other physicists, have actually measured this broadening in laboratory absorption lines. Unsöld applied the theory to the case of absorption in a stellar atmosphere and derived the numbers of atoms per square centimeter that are active in producing the H and the K lines of the solar spectrum. Miss Payne has tested the contours of the calcium lines in numerous stellar spectra and has found them to be in fair agreement with Unsöld's theory. Similar results have also been obtained at the Yerkes Observatory and the only serious discrepancies were found in stars known to be subject to rapid rotation. It should be mentioned in this connection that the central intensities of stellar lines are not equal to zero, as would be demanded by Unsöld's formula. Miss Payne has given convincing observational evidence for this departure, and Unsöld and Pannekoek have discussed the problem theoretically.

An interesting test can be made of Unsöld's theory by considering the relative intensities of different lines. His formula is essentially that proposed by Schwarzschild and by Schuster for the case of a scattering atmosphere: $i = i_0/(1 + \sigma l)$. This expression takes care of the effect of re-radiation by the various atoms. Were there no such re-emission the formula would be:

$$i = i_0 e^{-\sigma l}$$

In both expressions l is the length of the absorbing column. The exponential formula is that usually given in elementary textbooks; it assumes that in each centimeter of path in the absorbing medium a fraction σ of the light is lost, that is—transformed into heat. The quantity σ is called the absorption cofficient. For each atom it is inversely proportional to $(\lambda - \lambda_0)^2$, and for N atoms per cubic centimeter it is proportional to N. Hence we may write $\sigma = (\text{Const. } N)/(\lambda - \lambda_0)^2$. The total absorption of a line is obtained by integrating i over all wavelengths from minus infinity to plus infinity:

$$A = \int (1 - i)\, d\lambda.$$

This is the area enclosed by the horizontal line $i = 1$ at the top, and by the contour of the line at the bottom. The quantity A is usually expressed in angstrom units of "equivalent breadth." In other words, the area A is measured by the width of an equal area bounded by the intensity of the continuous spectrum at the top, the zero axis at the bottom, and two vertical lines at the sides.

No matter whether we use the Schuster-Schwarzschild expression or the ordinary exponential formula, A is found to be proportional to the square root of N. In the case of a multiplet the relative values of N are known. For example, K and H have theoretical intensities of 2:1. Accordingly, the total absorptions of these two lines should be in the ratio $\sqrt{2}:\sqrt{1}$ or 1.42. The measurements made by Unsöld, by Miss Payne and by other workers at Harvard and at the Yerkes Observatory, have confirmed the square-root law for all the stronger calcium lines and for many other members of multiplets in stellar spectra. For example, the silicon lines 4552, 4567, and 4574 were found to be approximately in the ratio $\sqrt{5}:\sqrt{3}:1$.

Thermal Agitation

The square-root law for the total intensities of absorption lines was tested for the solar spectrum by numerous observers. Minnaert and Woolley independently found large departures in the case of the fainter Fraunhofer lines. On the other hand, laboratory measurements by Korff, as well as measurements of the atmospheric lines in the solar spectrum by Childs, von Klüber, and others, confirmed the theory.

Evidently the contours of the fainter solar lines were not wholly defined by the natural width caused by radiation damping. Damping due to collisions, first investigated by Lorentz, may be present. In stellar spectra this type of damping should show a marked relation to absolute magnitude. While a critical study of this phenomenon is still lacking, it is probable that collisional damping does not play a predominating part in producing the observed contours.

There is, however, another effect which cannot be disregarded. Long ago Michelson pointed out that the random motions of the molecules in a gas at ordinary temperatures would be sufficient to cause a marked broadening of the lines. Since the motions of the atoms are distributed at random in accordance with Maxwell's law, the absorption coefficient may be represented in the following way:

$$\sigma = \text{const. } Ne^{-(\lambda-\lambda_0)^2/\alpha^2}$$

where

$$\alpha = \lambda_0 v_0/C \text{ and } v_0 = \sqrt{(2KT/m)}$$

Here N is the number of atoms per cm^3; λ_0 is the normal wave-length of the line; C the velocity of light, and v_0 the most probable velocity of the atoms, corresponding to the temperature of the gas T and the atomic weight m.

The above expression for the absorption coefficient simply states the fact that the motions of the atoms are distributed in accordance with the laws of the kinetic theory of gases. Each atom, of course, has its own absorption coefficient depending upon radiation damping, but for the moment we shall assume that "natural width" is negligible in comparison with thermal Doppler broadening.

Substituting the expression for σ in our exponential absorption formula, we have

$$I = I_0 e^{-\sigma l} = I_0 e^{-CNle^{-(\lambda-\lambda_0)^2/\alpha^2}}$$

If the line is faint, we can expand this expression into a power series with rapidly diminishing terms. Retaining only the first, we get:

$$I/I_0 = 1 - CNle^{-(\lambda-\lambda_0)^2/\alpha^2}$$

It is clear from this expression that the width of the line $2(\lambda - \lambda_0)$ for any given value of I/I_0 is proportional to

$$\sqrt{\log (\text{const. } N)}.$$

For the case of pure radiation damping we have found that $(\lambda - \lambda_0)$ is proportional to $\sqrt{N}$. Evidently, if N is increased the Doppler type of broadening proceeds more slowly than natural widening.

In reality, both types of broadening must be considered simultaneously. This was done by Voigt and others, and was applied by Schütz to the problem of laboratory absorption lines. Unsöld, Struve, and Elvey made an application of Schütz' results to the contours of interstellar calcium lines, while Pannekoek, Minnaert and Slob, and others developed the theory to account for the behavior of stellar and solar absorption lines.

Pannekoek found from Voigt's expression of the absorption coefficient, that the contour of a very faint line is determined almost entirely by thermal Doppler effect. For stronger lines, corresponding to larger values of N, the contour gradually deepens, and the total absorption increases in direct proportion to N. After the center of the line has become deep enough, the increase of the total absorption with N becomes slower and ceases almost completely. For a certain range of N the total absorption is practically independent of N. Then, as N is increased still more, radiation damping begins to dominate. Broad wings appear which spread out in accordance with the law $\sqrt{N}$ and the total absorption also increases as $\sqrt{N}$. The center of the line, however, continues to show a nucleus which is defined by Doppler effect and which is broader than the corresponding portion of the Unsöld contour.

For atomic weight 1, $T = 6000°$ and $\lambda_0 = 4000$ A, Pannekoek finds a Doppler core of approximately 1A in width. Now the hydrogen lines in the sun are, according to Unsöld, broadened by Stark effect, so that the Doppler core cannot be measured. For other elements, such as calcium, the atomic weight is large, the thermal motions are correspondingly small, and the Doppler core has a width of only 0.18 A.

The best chance of finding the thermal cores of spectral lines is in the hottest stars. We have seen that the core is proportional to $\sqrt{2KT/m}$. Accordingly, for a B_0 star in which $T = 24{,}000°$, the core is twice that found by Pannekoek for the sun. The hydrogen lines should have a core of 2A and the He lines a core of 1A.

Hydrogen is again unsuitable for this test. But helium is more promising. We have seen before that only some of the He I lines show a measurable amount of Stark effect. Such lines as λλ 4438, 4169, 4121, 3965, and 3868 are practically free of complications arising from electric fields, and are therefore eminently suitable for a test of thermal Doppler effect.

Observations of the spectra of B stars, made by Struve and Dunham, give no conclusive results. The lines 4438 and 3965 are probably a trace wider than similar lines of other elements, but actual measurements show only that the core is not larger than is predicted by the theory. The other helium lines are blended with faint lines of O II and of other elements and cannot be used. A dispersion slightly greater than that available at λ 3965, namely 7.8 A/mm, would doubtless be sufficient to measure the thermal broadening of the helium lines.

For the Fraunhofer lines in the sun, Minnaert and Mulders constructed a "curve of growth" in which they plotted the total absorptions of the lines against the relative numbers of atoms. The latter were inferred from the theoretical multiplet intensities. The curve shows for small N a stretch which is directly proportional to N. Then follows an almost horizontal stretch, where the total absorption is almost independent of N and remains approximately equal to 0.1 A of the continuous spectrum (or Rowland intensity 3), and this is followed by a stretch in which A is proportional to $\sqrt{N}$. The horizontal part of the curve agrees with the requirements of the theory. To be exact, it should be at $A = 0.1$ Å for an element of $m = 50$ and $T = 10{,}000$. For the sun, $T = 6000$, and the horizontal part should fall slightly below $A = 0.1$ Å.

For the hotter stars the horizontal part shifts slightly towards larger values of A, but the shift is not very sensitive to temperature. At any rate, for stars of $T \leqq 10000°$ the conclusion is justified that practically all lines stronger than $A = 0.1$ Å would conform to the square-root law: A is proportional to $\sqrt{N}$.

(To be continued.)

Planet Notes for December, 1935

By CLIFFORD E. SMITH

Note: All times are Central Standard Time unless otherwise stated.

The *Sun* will be moving with a southeasterly motion until the occurrence of the winter solstice on December 22, 37^m past noon. After the latter date the apparent motion of the sun will be northeasterly again. On Christmas Day there will be an annular eclipse of the sun, visible in the Antarctic. The sun's motion among the constellations will be from central Scorpio to central Sagittarius. Its distance from the earth will vary from about 91.6 to about 91.3 million miles. The position of the sun on the first and last days of the month will be, respectively: R.A. 16^h 24^m, Decl. —21° 38′; and R.A. 18^h 37^m, Decl. —23° 11′.

The phenomena of the *Moon* will occur as follows:

First Quarter	Dec.	3 at	1 A.M.
Full Moon		9 "	9 P.M.
Last Quarter		17 "	4 P.M.
New Moon		25 "	Noon
Perigee		5 "	4 P.M.
"		30 "	9 A.M.
Apogee		17 "	9 P.M.

Mercury will be moving with an apparent easterly motion from the northern part of Scorpio to the eastern part of Sagittarius. It will be near the sun in apparent position until near the end of the month, when it will become an evening star. At the end of the month it will follow after the sun by about 12 degrees (about 24 diameters of the moon). Superior conjunction with the sun will occur on December 10 at 1:00 A.M. The position of Mercury on the last day of the month will be R.A. $19^h\ 29^m$, Decl. $-24°\ 4'$.

Venus will be a morning object rising about three hours before the sun. At the beginning of the month it will be some two or three degrees from the bright star Spica in Virgo. Its apparent motion among the stars will be in an easterly direction to the eastern part of Capricornus. Its distance from the earth will be about 72 million miles at the beginning of the month, and this distance will increase about 20 million miles during the month. The corresponding change in apparent diameter will be from about 22 to about 17 seconds of arc. Conjunction with the moon will occur at midnight on December 21 (Venus $7°.2$ S).

Mars will be in the evening sky, setting about three hours after the sun. Its distance from the earth at the beginning of the month will be about 170 million miles, and this distance will increase about ten per cent during the month. Its apparent diameter will be about five seconds of arc. It will be moving with an apparent easterly motion from the northern part of Sagittarius to the eastern part of Capricornus. Conjunction with the moon will occur at 6:00 P.M. on December 28 (Mars $4°.5$ S).

Jupiter will be comparatively near the sun in apparent position since conjunction with the sun will have occurred late in November. By the end of the month, however, it will be a morning star rising about an hour after Venus. Conjunction with the moon will occur on December 23.

Saturn will be in the evening sky in central Aquarius. For northern observers it will be towards the south at sunset during the first part of the month, since quadrature east will have occurred late in November. Its distance from the earth will be about 926 million miles, and its apparent diameter will be about 15 seconds of arc (not including rings). Conjunction with the moon will occur on December 2 at 7:00 P.M. and on December 30 at 4:00 A.M. (Saturn about $6°.5$ S).

Uranus will be a night object in southern Aries. During the middle of the month it will rise about 5:00 P.M. local standard time. Its distance from the earth will be about 1780 million miles, and its apparent diameter will be about 3.6 seconds of arc. Its position on December 16 will be R.A. $1^h\ 59^m$, Decl. $+11°\ 38'$. Conjunction with the moon will occur on December 6 at 8:00 P.M. (Uranus $5°.7$ S).

Neptune will be a morning object in eastern Leo, rising about midnight. It will be at quadrature west of the sun at noon on December 9. Conjunction with the moon will occur on December 17 at 4:00 A.M. (Neptune $6°.3$ N). Its position on December 16 will be R.A. $11^h\ 13^m$, Decl. $+6°\ 8'$. Its apparent diameter will be about 2.4 seconds of arc.

OCCULTATION PREDICTIONS

(Taken from the *American Ephemeris.*)

The quantities in the columns *a* and *b* are given for the purpose of making these predictions useful for any place within 200 miles of the point indicated. The procedure is as follows: Subtract the longitude of the point given from the longitude of the place in question; multiply the result, taking the signs into account, by the quantity under *a* for the star to be observed; similarly, with the latitude, using *b*; apply the sum of the products, with its proper sign, to the Greenwich C.T., and obtain the predicted Greenwich Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to subtract five hours; Central Standard Time, six hours, etc.

OCCULTATIONS VISIBLE IN LONGITUDE +72° 30′, LATITUDE +42° 30′.

Date 1935		Star	Mag.	IMMERSION Greenwich C.T. h m	IMMERSION *a* m	IMMERSION *b* m	IMMERSION Angle E from N °	EMERSION Greenwich C.T. h m	EMERSION *a* m	EMERSION *b* m	EMERSION Angle E from N °
Dec.	4	κ Psc	4.9	4 34.8	—0.3	—1.4	93	5 24.8	0.0	+0.4	216
	7	47 B.Ari	6.5	4 25.6	..	..	345	4 30.0	..	..	335
	7	47 Ari	5.8	22 38.1	—0.9	+1.3	93	23 35.9	—0.4	+2.2	221
	8	33 Tau	6.0	22 2.8	—0.5	+0.8	113	22 46.7	+0.2	+2.4	214
	9	36 Tau	5.7	2 3.3	..	..	359	2 21.4	..	..	331
	9	62 Tau	6.2	11 18.1	..	..	20	11 34.0	..	..	343
	9	315 B.Tau	6.3	21 25.0	+0.7	+1.7	47	22 7.6	—0.1	+0.7	295
	11	8 Gem	6.1	6 51.9	—1.7	—0.8	97	8 9.5	—1.2	—1.7	291
	11	9 Gem	6.3	7 29.5	—1.0	—2.6	140	8 31.8	—1.8	—0.3	250
	11	36 B.Gem	6.0	11 36.5	+0.1	—1.5	108	12 30.5	+0.3	—1.4	281
	13	10 H.Cnc	6.1	5 0.5	..	..	50	5 40.6	..	..	350
	13	ζ^1 Cnc	5.1	10 13.3	—0.7	—2.2	137	11 19.6	—0.9	—1.6	278
	15	o Leo	3.8	4 22.3	—0.7	0.0	129	5 32.3	—1.1	+0.9	279
	28	53 B.Aqr	6.5	21 33.7	—0.1	+1.7	11	22 20.7	—1.9	—2.0	285

OCCULTATIONS VISIBLE IN LONGITUDE +91° 0′, LATITUDE +40° 0′.

Dec.	4	κ Psc	4.9	4 26.0	—1.0	—1.4	94	5 20.0	—0.3	+0.9	209
	7	47 Ari	5.8	22 27.2	—0.1	+1.5	75	23 24.0	—0.2	+1.7	242
	8	33 Tau	6.0	21 59.2	+0.2	+1.0	97	22 46.8	+0.3	+1.7	233
	9	62 Tau	6.2	11 10.4	—0.3	—0.5	62	11 56.9	+0.6	—1.8	303
	11	8 Gem	6.1	6 18.3	—2.0	—0.9	116	7 40.5	—2.2	0.0	263
	11	36 B.Gem	6.0	11 41.7	0.0	—2.2	136	12 33.2	—0.4	—1.0	256
	13	10 H.Cnc	6.1	4 31.4	—0.6	+3.2	58	5 21.1	—1.4	—1.8	331
	13	ζ^2 Cnc	5.1	10 14.9	..	..	184	10 48.1	..	..	233
	15	o Leo	3.8	4 14.4	—0.2	—0.1	133	5 13.5	—0.4	+1.4	268

OCCULTATIONS VISIBLE IN LONGITUDE +120° 0′, LATITUDE +36° 0′.

Dec.	3	κ Aqr	5.3	5 38.0	—0.6	+0.5	44	6 38.2	—0.5	—0.7	255
	4	κ Psc	4.9	3 43.6	—1.8	+0.4	68	4 57.5	—1.1	+1.0	221
	4	9 Psc	6.4	3 55.7	—2.9	—1.8	108	4 42.1	—0.1	+3.2	182
	9	62 Tau	6.2	11 0.0	—0.7	—1.6	109	12 2.4	—0.7	—0.8	256
	11	8 Gem	6.1	5 26.3	—1.5	+0.1	116	6 36.1	—1.4	+1.9	246
	13	10 H.Cnc	6.1	4 22.8	+0.9	+3.5	41	4 53.4	—1.0	—1.9	339
	20	75 Vir	5.6	10 26.9	—0.5	+1.8	82	11 17.4	+0.1	—1.2	336
	28	ρ Cap	5.0	1 1.6	..	..	132	1 24.4	..	..	170
	29	72 B.Aqr	6.5	4 3.2	..	..	341	4 11.8	..	..	322

Change from 5″ to 3″ in the Reduction of the Occultations observed in 1936

Beginning with the first lunation of 1936 (New Moon, 1935 December 25) it is requested that 3″ be added to the moon's mean longitude instead of the 5″ used during the past three years. This is equivalent to the addition of $0.00152\,\Delta a$,

0.00152 $\Delta\delta$, where $\Delta\alpha$, $\Delta\delta$ are the variations of the moon's position per *hour* (the variation per minute being no longer printed), or to that of $0^h00152 = 0^m091 = 5^s5$ to the time at which the moon's position is obtained from the ephemeris.

The *American Ephemeris* and the *British Nautical Almanac* for the year 1936 give for the first time an additional list of occultation stars between magnitude 6.6 and 7.5. The positions of these stars were obtained from a catalogue of zodiacal stars prepared by J. C. Hammond from observations made during the years 1927-1930 with the 6-inch transit circle of the Naval Observatory at Washington. For the brighter occultation stars the positions published in the *British Nautical Almanac* are obtained from this same catalogue. It is suggested to computers of reductions of occultations observed during 1936 that the positions of the brighter stars as given in the *British Nautical Almanac* be used, in preference to the positions obtained from Hedrick's Zodiacal Catalogue.

It is also suggested that in future publications of occultation reductions the angle χ as well as $\chi - \rho$ be given in order to facilitate computations of the effects of altered star positions.

Ernest W. Brown, Dirk Brouwer.

Yale University, New Haven, 1935 September.

Variable Stars

Monthly Report of the American Association of Variable Star Observers for September, 1935

We welcome initial reports from Messrs. C. Butler, Fort Worth, Texas; E. Holly, South Norwalk, Connecticut; Y. Katz, Milwaukee, Wisconsin; R. B. Schattle, Syracuse, New York; J. Schmid, Milwaukee, Wisconsin; T. C. Setzer, Webster Groves, Missouri; B. F. Starnes, Jr., Monroe, North Carolina; and H. A. Washburn, St. Helena, California.

Nova Herculis still remains at, or near, the seventh magnitude with only slight fluctuations. SU Tauri has evidently taken the occasion to drop to another minimum while in conjunction with the sun. RY Sagittarii is at normal maximum magnitude, as is S Apodis. R Coronae Borealis has nearly attained normal maximum brightness. About a year has passed since the long-expected decrease occurred late in 1934. Will the next maximum be of ten years duration? Only time will tell and the star must be closely observed.

R Aquarii has risen from a deep minimum of the eleventh magnitude, to a maximum at the eighth magnitude. The 1934-35 minimum was the faintest recorded since 1924. Southern observers are especially requested to follow this variable as long as possible.

It is of interest to note that sixty different observers secured the two hundred and eighty-five observations made on R Coronae Borealis reported this month. While at first glance this may seem to be an over-abundance of observations on one particular star, yet it does represent the interest displayed by members and results in giving us a mean light curve which it is hard to excell.

Although there seems to be considerable disparity in the observations of Nova Herculis, this can be partly explained by the divergence of the size of instruments used in making the observations. In telescopes of low optical power and small light

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

July 0 = J.D. 2427984; August 0 = J.D. 2428015; September 0 = J.D. 2428046.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
SS CAS			T AND			R AND			U CAS			RV CAS			U TUC		
000451			001627			001838			004047a			004746a			*005475*		
994	12.7	Fc	052	9.5	Hf	033	7.7	Dl	041	8.5	Hm	056	9.9	Cm	990	8.9	Ht
018	12.8	Dh	053	9.2	Es	033	7.0	Hm	044	8.6	Hm	— CAS			004	8.7	Ht
032	12.1	Ra	055	9.2	Es	035	7.5	Bu	044	8.5	Jo	004746b			012	8.7	Ht
032	12.4	Wa	056	9.2	Wd	036	8.0	SS	045	8.6	Hm	033	10.6	Jo	Z CET		
033	12.4	Rb	056	9.1	Cm	036	7.5	Fc	047	8.4	Lt	038	10.5	Jo	*010102*		
033	12.6	Jo	T CAS			037	7.5	Fc	048	8.7	Jo	040	10.5	Jo	001	9.5	Fc
034	11.8	Ba	001755			038	8.2	Cx	053	8.9	Es	048	10.4	Jo	043	12.8	Hk
035	12.3	Dh	000	9.4	Fc	038	8.3	Dl	053	8.7	Hf	051	10.5	Pt	051	12.8	Pt
036	12.0	Hk	034	8.6	Ba	038	7.7	Jo	056	8.7	Wd	052	10.8	Cm	U AND		
036	12.4	Fc	035	9.4	Bu	038	8.0	Hf	056	8.6	Cm	052	11.1	Kg	010940		
038	12.4	Rb	036	9.4	Fc	038	7.8	Wd	RW AND			056	11.1	Cm	038	[12.0	Jo
038	12.5	Jo	037	9.9	Fc	038	7.1	Hm	004132			056	10.9	Wd	UZ AND		
038	12.3	Ma	038	9.4	Wd	039	7.0	Ca	000	[12.6	Fc	W CAS			011041		
038	11.8	Hk	038	9.5	Dl	040	7.9	Ma	033	9.0	Jo	004958			040	[14.2	Ma
039	12.2	Wa	038	9.8	Jo	040	7.5	Bu	038	8.6	Jo	000	9.1	Fc	S CAS		
042	11.7	Hk	038	9.3	Hf	040	7.0	Hm	038	8.7	Hf	001	8.7	Sn	011272		
043	11.7	Hk	039	8.7	Mc	041	8.0	Jo	041	8.6	Jo	003	9.0	Fc	019	11.7	Mo
044	11.3	Bj	041	9.7	Jo	043	7.3	Fc	041	8.7	Lt	003	9.0	Sn	034	11.3	Jo
045	11.8	Hk	042	9.1	Mc	044	7.3	Hm	044	8.5	Jo	003	9.0	Ku	038	11.3	Jo
048	12.4	Jo	043	9.2	Fc	044	8.1	Jo	047	8.5	Lt	004	8.7	Sn	038	11.7	Hf
052	11.3	Cm	044	9.7	Jo	045	8.2	Bk	048	8.4	Jo	007	9.0	Sn	040	11.8	Mo
052	11.3	Kg	046	9.0	Mc	045	8.0	SS	051	8.6	Lt	015	9.2	Ku	040	11.2	Jo
053	11.2	Es	048	9.5	Jo	048	8.0	Jo	051	8.7	Md	018	9.2	Dh	044	11.4	Jo
055	11.2	Es	050	9.1	Dl	050	8.4	Dl	051	8.2	Pt	018	9.2	Ku	048	11.0	Jo
056	11.3	Wd	051	8.9	Mc	050	8.2	Bu	053	8.5	Hf	028	9.1	Ku	051	11.7	Pt
056	11.2	Wp	051	9.0	Pt	051	8.0	Pt	055	8.3	Es	028	9.1	Dh	056	12.0	Cm
056	11.1	Cm	052	9.5	Cm	051	8.6	Md	056	8.5	Wd	032	8.7	Jo	U PSC		
056	11.2	Wa	052	8.9	Kg	052	8.3	Cx	056	8.5	Cm	032	9.4	Ra	011712		
S SCL			052	9.2	Hf	052	8.2	Hs	V AND			034	9.1	Dh	001	11.6	Fc
001032			052	9.6	Gy	052	8.2	Hf	004435			035	9.3	Dh	051	[12.3	Pt
013	11.4	dK	053	8.9	Dl	053	8.4	Dl	038	11.6	Hf	035	9.2	Bu	RZ PER		
020	11.2	dK	054	9.1	Dl	055	8.3	Es	044	11.3	Jo	035	9.3	Ku	012350		
040	11.0	dK	056	8.9	Cm	056	9.2	Cm	053	10.7	Hf	036	9.2	Dh	001	10.8	Fc
X AND			R AND			S TUC			055	10.8	Es	037	9.4	Fc	034	9.8	Jo
001046			001838			*001862*			RR AND			038	9.4	Dh	038	9.5	Jo
040	[13.8	Fc	964	6.6	Ah	012	11.1	Ht	004533			038	8.8	Jo	041	9.6	Jo
T CET			976	6.5	Ah	S CET			000	9.1	Fc	038	9.6	Hf	044	9.7	Jo
001620			983	6.4	Ah	*001909*			003	9.1	Fc	038	9.6	Wd	048	9.5	Jo
022	5.8	Lt	984	6.4	Ah	040	[13.7	Fc	034	9.2	Jo	039	9.6	Ca	R PSC		
037	5.9	Lt	985	6.4	Ah	Y CEP			037	10.8	Fc	040	9.4	Ku	012502		
042	5.7	Lt	990	6.5	Ah	003179			038	10.7	Hf	040	9.5	Dh	008	9.0	Ah
047	5.8	Lt	991	6.6	Bk	031	[13.6	Br	040	10.4	Jo	041	9.0	Jo	033	9.0	Jo
052	5.8	Lt	992	6.4	Ah	042	[14.4	Br	043	11.0	Fc	042	9.5	Dh	038	9.2	Jo
T AND			993	6.4	Ah	U CAS			044	10.8	Bj	044	9.0	Jo	038	9.8	Hf
001726			994	6.3	Ah	004047a			RV CAS			045	9.7	Ke	039	9.6	Kn
019	[11.8	Mo	995	6.3	Ah	000	10.3	Fc	004746a			046	9.6	Dh	044	9.2	Jo
033	12.0	Jo	005	6.8	Ah	003	10.1	Fc	033	9.7	Jo	048	9.2	Jo	051	10.2	Pt
038	11.6	Jo	007	6.8	Ah	032	8.5	Jo	038	9.4	Jo	051	9.4	Bu	RU AND		
038	11.6	Hf	010	6.9	SS	033	8.5	Hm	038	9.0	Hf	051	8.9	Pt	013238		
040	11.6	Mo	013	6.9	Bk	036	8.3	Lt	040	9.5	Jo	052	9.6	Gy	001	10.8	Fc
040	11.0	Fc	018	6.9	SS	037	8.2	Fc	044	9.3	Jo	054	9.7	Cm	044	11.5	Bj
041	11.5	Jo	019	7.2	Kp	038	8.5	Hm	048	9.5	Jo	056	9.7	Cm	051	11.7	Pt
044	11.0	Jo	020	7.1	Kp	038	8.6	Hf	051	9.5	Pt	056	9.9	Wd	056	11.9	Cm
048	10.7	Jo	023	7.2	SS	038	8.5	Jo	052	9.8	Cm	U TUC			Y AND		
051	9.6	Lt	031	6.9	Hm	040	8.2	Fc	052	10.2	Kg	*005475*			013338		
051	9.8	Md	032	7.1	Hm	041	8.4	Jo	053	10.0	Hf	980	9.2	Ht	044	11.3	Bj
051	9.1	Pt	032	7.8	Jo	041	8.4	Lt	056	9.8	Wd	985	8.8	Ht	044	11.9	Jo

Variable Star Observations Received During September, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
Y And			**RV And**			**T Per**			**S Per**			**TX Per**			**R Hor**		
013338			020448			021258			021558			024136			*025050*		
048	11.6	Jo	053	9.3	Wp	051	9.3	Lt	050	9.2	Dl	035	10.7	Hk	012	10.5	dK
051	10.5	Pt	053	9.5	Wa	051	8.8	Pt	051	8.7	Pt	036	10.7	Hk	019	9.9	dK
056	9.8	Cm	**R Ari**			053	9.0	Dl	052	9.2	Gy	038	11.0	Hk	026	8.6	dK
X Cas			021024			054	9.3	By	052	9.0	Hs	039	11.2	Wa	036	7.1	dK
014958			993	10.5	Ah	054	9.3	Si	053	9.1	Dl	042	10.9	Hk	**T Hor**		
034	12.3	Jo	995	10.0	Ah	056	8.7	Cm	054	9.2	By	045	10.8	Hk	*025751*		
038	12.2	Jo	001	9.8	Fc	**Z Cep**			054	9.2	Si	056	10.8	Cm	036	9.2	dK
041	12.4	Jo	004	9.7	Hk	021281			055	9.1	Si	056	10.8	Wa	**U Ari**		
048	12.5	Jo	008	9.1	Ah	031[	13.0	Br	056	8.9	Cm	**T Ari**			030514		
051	12.6	Pt	009	9.1	Ah	042[	14.6	Br	**R Cet**			024217			039	9.1	Kn
053	12.1	Es	015	8.9	Hk	051[	12.5	Pt	*022000*			015	11.3	Hk	052	9.2	Jo
U Per			018	9.1	Dh	**o Cet**			034	9.2	Jo	038	10.1	Jo	**X Cet**		
015254			035	8.5	Dh	*021403*			038	9.4	Jo	039	10.4	Kn	031401		
001	8.1	Fc	035	8.5	Ku	001	9.0	Fc	038	9.9	Hf	040	10.0	Jo	043	12.2	Hk
003	8.1	Fc	036	8.7	Dh	008	9.4	Ah	039	9.9	Kn	044	9.7	Jo	051	10.8	Pt
016	8.6	Ry	038	8.5	Dh	018	9.2	Dh	043	10.1	Hk	052	9.7	Jo	052	11.4	Gy
019	8.7	Ry	038	8.5	Jo	033	9.2	Jo	044	9.6	Jo	**W Per**			052	10.8	Jo
020	9.0	Kn	038	8.3	Ma	035	9.3	Dh	052	9.5	Jo	024356			**Y Per**		
022	9.0	Ry	038	8.8	Hf	036	9.3	Dh	**RR Per**			993	10.0	Bk	032043		
032	8.9	Jo	039	8.5	Kn	038	9.2	Dh	022150			000	9.9	Sn	985	9.8	Ah
034	9.2	Ba	040	8.3	Ma	038	9.1	Jo	051[	12.9	Pt	001	9.3	Fc	993	9.6	Ah
035	9.3	Ry	040	8.6	Dh	038	9.2	Ma	**R For**			003	10.1	Ky	007	9.6	Ah
038	9.2	Jo	043	8.8	Dh	038	9.3	Hf	*022426*			016	9.9	Ry	009	9.4	Ah
038	9.8	Hf	044	8.7	Jo	039	9.4	Kn	006	9.2	Fc	018	9.5	Hv	032	8.8	Jo
039	9.5	Mc	046	8.8	Dh	040	9.3	Dh	**U Cet**			018	10.4	Dh	036	8.3	Bc
041	9.3	Jo	051	8.4	Bu	042	9.2	Pb	*022813*			018	9.4	Bc	036	8.3	Hv
042	9.7	Ry	051	8.2	Pt	043	9.1	Pb	039	9.3	Lt	019	9.6	Bc	038	8.7	Jo
046	9.0	Mc	052	8.7	Jo	043	9.3	Hk	043	9.0	Hk	019	10.0	Ry	039	8.9	Mc
048	9.9	Jo	052	8.8	Ca	043	9.2	Dh	047	8.8	Lt	019	9.6	Hv	041	8.8	Jo
051	8.9	Mc	056	8.7	Wd	044	9.0	Jo	051	8.5	Pt	022	9.8	Ry	044	8.5	Jo
051	9.8	Pt	**W And**			051	8.8	Pt	054	8.4	Lt	029	9.5	Hv	045	8.3	Hv
052	9.8	Ba	021143a			052	8.9	Jo	056	8.6	Cm	032	9.5	Jo	045	8.3	Bc
056	10.1	Cm	040	10.8	Jo	**S Per**			**RR Cep**			032	9.5	Bc	046	9.0	Mc
S Ari			044	10.0	Jo	021558			022980			035	9.8	Ry	051	8.8	Mc
015912			044	10.0	Bj	001	8.7	Fc	033[	13.9	Br	035	10.2	Dh	**R Per**		
001[	12.0	Fc	048	9.7	Jo	019	9.0	Mo	042	13.9	Br	036	10.1	Dh	032335		
015[	12.0	Hk	051	9.8	Pt	020	8.9	Kn	051[	12.9	Pt	036	9.4	Hv	040	13.7	Ma
040[	14.3	Fc	052	9.7	Gy	031	9.2	Hm	**R Tri**			036	9.4	Bc	051[	12.3	Pt
053	14.5	Wa	**T Per**			032	8.8	Jo	023133			038	10.1	Dh	**RU Per**		
RV And			021258			033	9.3	Hm	008	11.0	Ah	038	9.6	Jo	032339		
020448			955	9.6	Si	033	9.1	Dl	018	11.6	Dh	039	10.3	Mc	012	11.0	Hk
996	10.0	Hk	019	9.0	Lt	034	9.2	Dl	035	11.6	Dh	040	10.0	Dh	018	11.4	Dh
004	10.0	Hk	020	8.5	Kn	035	9.0	Dh	036	11.5	Dh	041	9.8	Jo	035	11.6	Hk
009	10.1	Hk	031	9.1	Hm	036	9.1	Dh	038	11.3	Dh	041	10.1	Hf	036	11.8	Hk
012	10.1	Hk	032	8.4	Jo	038	9.2	Dl	038	11.3	Hf	042	10.2	Dh	038	11.8	Hk
015	10.0	Hk	033	9.0	Dl	038	9.0	Fs	040	11.5	Ma	042	9.9	Ry	042	11.9	Hk
034	9.6	Jo	033	9.1	Hm	038	8.4	Jo	040	11.4	Dh	043	10.2	Dh	043	11.8	Hk
035	10.0	Hk	034	8.9	Dl	038	9.1	Hf	043	11.1	Dh	044	9.7	Jo	044	11.2	Jo
036	9.6	Hk	038	9.0	Dl	038	9.1	Wd	046	11.0	Dh	045	9.4	Bc	045	11.9	Hk
038	9.6	Hk	038	8.4	Jo	038	9.3	Hm	051	9.8	Bu	045	9.4	Hv	053	11.8	Wp
038	9.7	Jo	038	8.8	Hf	038	9.1	Dh	051	9.5	Pt	046	10.1	Dh	053	12.0	Wa
038	10.0	Ma	038	9.0	Wd	040	9.1	Dh	053	10.0	Dl	046	10.3	Mc	**Nov Per**		
041	9.6	Jo	038	9.0	Hm	041	8.7	Jo	056	9.7	Wd	050	9.7	Dl	032443		
041	10.0	Hf	041	9.2	Hm	041	9.2	Hm	056	9.7	Cm	051	10.1	Mc	037	13.6	Ar
042	9.6	Hk	041	8.5	Jo	042	8.9	Dh	**TX Per**			051	9.7	Pt	038	13.6	Ar
042	9.8	Jo	042	9.1	Lt	043	9.5	Dh	024136			053	9.8	Dl	042	13.5	Ar
043	9.7	Hk	044	8.6	Jo	044	8.8	Jo	012	10.7	Hk				043	13.4	Ar
045	9.6	Hk	050	9.1	Dl	046	9.2	Dh	018	10.7	Dh				045	14.0	Ar

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
NOV PER			T CAM			R AUR			β DOR			SV AUR			V GEM		
032443			043065			050953			*053262*			055646b			071713		
051	13.5	Pt	031	8.7	Hm	008	9.1	Ah	979	4.4	Df	043	10.1	Dh	052	9.4	Jo
U CAM			032	8.8	Hm	038	7.7	Jo	021	3.4	Df	XZ AUR			056	8.5	Pt
033362			033	8.8	Hm	039	7.8	Kn	RU AUR			055647			S CMI		
031	8.1	Hm	033	9.1	Dl	044	7.7	Jo	053337			018	11.3	Dh	072708		
032	8.2	Hm	034	9.5	Jo	052	7.8	Jo	056	9.6	Pt	035	11.7	Dh	914	7.6	Si
032	8.7	Wa	037	9.0	Kn	056	7.4	Pt	U AUR			R OCT			038	10.7	Cm
032	8.5	Wp	038	8.8	Hm	056	8.3	Cm	053531			*055686*			039	11.2	Cm
033	8.3	Hm	039	9.2	Jo	T PIC			008	10.0	Ah	985[	12.2	Ht	056	11.7	Pt
034	8.2	Jo	041	8.9	Jo	*051247*			052	8.7	Jo	990	11.9	Bl	T CMI		
037	8.2	Kn	044	8.8	Jo	012	10.2	dK	056	8.4	Pt	012[	12.2	Ht	072811		
038	8.1	Hm	050	8.8	Dl	019	9.7	dK	Z TAU			X AUR			056	11.3	Pt
040	7.7	Jo	053	8.7	Dl	026	9.2	dK	054615a			060450			S VOL		
041	8.2	Hm	056	8.8	Pt	036	8.6	dK	042	10.7	Ar	056	8.3	Pt	*073172*		
044	8.3	Hm	RX TAU			NOV TAU			043	10.8	Hk	V MON			973	12.0	En
044	7.7	Jo	043208			051316			043	11.0	Cm	*061702*			979	12.0	Ht
053	8.4	Wp	042	13.9	Ar	043	13.0	Ar	055	10.3	Bj	056[	12.9	Pt	984	11.7	Ht
053	8.2	Wa	056[	12.8	Pt	S AUR			RS TAU			U LYN			989	11.7	Ht
X PER			R RET			052034			054615b			063159			990	11.6	Bl
034930			*043263*			038	9.7	Jo	042	9.0	Ar	987[	13.3	Ap	003	11.7	Ht
042	6.7	Mc	990	11.0	Bl	052	9.4	Jo	RU TAU			NOV PIC			008	11.6	Ht
046	6.1	Mc	X CAM			056	9.1	Pt	054615c			*063462*			014	11.8	Ht
051	6.3	Mc	043274			W AUR			042	13.7	Ar	979	9.1	Ht	U CMI		
T ERI			020	10.5	Md	052036			R COL			984	8.9	Ht	073508		
035124			024	11.2	Md	038[	12.0	Jo	*054639*			989	9.1	Ht	056	12.4	Pt
051	11.9	Bj	029	11.5	Md	052	11.4	Jo	054[	13.4	Bj	S LYN			Y GEM		
R TAU			036	12.3	Md	056	10.6	Pt	U ORI			063558			073520		
042209			039	12.5	Jo	056	10.8	Cm	054920a			016	10.8	Ry	039	9.9	Cm
038	14.0	Cm	041	12.6	Jo	RR CAM			038	12.1	Cm	019	10.7	Ry	042	9.6	Hk
040	14.1	Ma	044	12.5	Jo	052372			052	11.3	Jo	036	10.1	Ry	043	9.7	Hk
042	13.8	Ar	056	12.7	Pt	987	10.2	Fc	056	11.8	Pt	052	9.9	Jo	S GEM		
043	13.9	Cm	R DOR			994	10.2	Fc	V CAM			X GEM			073723		
055	13.2	Bj	*043562*			996	9.9	Hk	054974			064030			039	9.7	Cm
W TAU			990	5.5	Bl	040	9.6	Jo	987[	14.2	Ap	039	12.7	Cm	056	8.8	Pt
042215			V TAU			056	9.8	Cm	040[	11.5	Jo	SW GEM			W PUP		
018	10.4	Dh	044617			056	9.3	Wa	056[	12.6	Pt	065326			*074241*		
035	10.4	Dh	042	13.2	Ar	S ORI			Z AUR			039	8.9	Cm	973	8.8	En
036	10.4	Dh	056[	12.4	Pt	*052404*			055353			042	8.7	Hk	979	8.8	Ht
038	10.4	Jo	R ORI			038	10.6	Cm	032	10.1	Jo	043	8.5	Hk	984	9.0	Ht
038	10.4	Dh	045307			043	10.1	Dh	038	10.0	Jo	RS GEM			989	9.1	Ht
040	10.6	Dh	038	13.5	Cm	052	10.7	Jo	042	10.1	Mc	065530			990	9.0	Bl
042	10.4	Dh	051	13.0	Bj	056	9.7	Pt	044	10.2	Jo	039	12.1	Cm	995	9.2	Ht
042	10.8	Ar	R LEP			S CAM			046	10.0	Mc	042	11.3	Hk	003	9.4	Ht
042	10.7	Hk	*045514*			053068			051	10.1	Mc	043	11.5	Hk	T GEM		
043	10.6	Hk	021	7.2	Df	019	9.5	Hh	052	9.6	Gy	R GEM			074323		
043	10.5	Dh	052	7.6	Jo	020	8.9	Md	056	9.6	Pt	070122a			039	8.8	Cm
046	10.6	Dh	056	6.6	Pt	024	9.5	Md	RS AUR			039	13.4	Cm	056	8.2	Pt
051	10.9	Pt	V ORI			029	9.8	Md	055646a			056[	12.1	Pt	RZ UMA		
052	10.6	Jo	050003			034	9.0	Jo	018	9.8	Dh	TW GEM			080165		
S TAU			038	13.4	Cm	036	9.2	Md	035	9.9	Dh	070122c			987	8.5	Fc
042309			051	12.8	Bj	037	9.1	Md	035	10.1	Hk	054	8.2	Lt	994	8.5	Fc
038	13.5	Cm	T LEP			038	9.8	Hh	036	10.0	Hk	R VOL			003	8.5	Fc
040	12.9	Ma	*050022*			039	9.1	Jo	043	10.1	Hk	*070772*			009	8.4	Hk
042	13.2	Ar	056	12.8	Pt	041	9.2	Jo	043	10.2	Dh	979[	13.4	Ht	012	8.3	Hk
043	12.7	Cm	S PIC			045	9.7	Md	SV AUR			989[	13.4	Ht	020	8.5	Md
051	12.0	Pt	*050848*			049	9.7	Md	055646b			014[	13.4	Ht	023	8.2	Md
055	11.7	Bj	019	10.7	dK	056	9.6	Pt	018	9.5	Dh	L_2 PUP			027	8.6	Md
			026	10.4	dK				035	9.8	Dh	*071044*			033	8.3	Md
			036	9.4	dK							021	4.6	Df	035	8.3	Md

Variable Star Observations Received During September, 1935.

J.D. Est. Obs. J.D. Est. Obs. J.D. Est. Obs. J.D. Est. Obs. J.D. Est. Obs. J.D. Est. Obs.

RZ UMa
080165
035 8.6 Hk
036 8.5 Hk
036 8.0 Md
038 8.3 Md
038 8.5 Hk
040 8.5 Jo
041 8.3 Md
042 8.6 Hk
043 8.5 Hk
044 8.6 Jo
045 8.6 Hk
045 8.3 Md
047 8.3 Md
053 8.6 Md

R Cnc
081112
056 9.1 Pt

T Lyn
081633
042 10.4 Hk
043 10.2 Hk

R Cha
082476
973 7.9 En
979 8.8 Ht
984 8.8 Ht
987 8.4 En
989 8.9 Ht
990 8.6 Bl
003 9.3 Ht
008 9.8 Ht
014 10.0 Ht

X UMa
083350
043 12.2 Cm

T Cnc
085120
056 8.0 Pt

V UMa
090151
963 9.8 So
040 10.1 Mc
043 10.7 Cm
044 10.2 Mc
050 10.3 Mc
052 11.0 Jo

RX UMa
090567
004 9.8 Ks

RW Car
091868
973 12.8 En
979 12.9 Ht
980 12.8 En
984 12.0 Ht
989 12.1 Ht
990 12.2 Bl
003 11.8 Ht
008 11.4 Ht
014 11.4 Ht

Y Vel
092551
973 11.0 En
979 11.0 Ht
980 10.6 En
984 10.5 Ht
987 10.6 En
989 10.4 Ht
990 10.2 Bl
995 10.2 Ht
003 10.1 Ht
008 10.0 Ht
013 10.2 dK
014 10.2 Ht
020 10.6 dK
027 10.5 dK
036 10.9 dK

R Car
093062
973 9.0 En
979 9.1 Ht
980 9.2 En
984 9.1 Ht
989 8.9 Ht
990 8.7 Bl
995 8.8 Ht
003 8.6 Ht
008 8.4 Ht
012 8.0 Ss
013 8.8 Df
013 8.2 dK
014 8.3 Ht
015 7.3 Ss
020 8.0 dK
021 7.4 Df
027 7.5 dK
036 7.0 dK

Y Dra
093178
004 13.5 Ks
015[12.9 Hk

R LMi
093934
986 6.5 Ks

RR Hya
094023
973 13.5 En

R Leo
094211
855 9.6 Ss
920 8.6 Si
948 7.6 Ss
949 8.6 ST
949 8.4 Si
986 5.8 Ks

Y Hya
094622
973 8.0 En
980 8.0 En
987 8.0 En

S LMi
094735
987 10.0 Fc
994 8.9 Fc

U LMi
094836
994[12.4 Fc

Z Vel
094953
973 9.2 En
979 9.6 Ht
980 8.9 En
984 8.9 Ht
987 8.2 En
989 8.9 Ht
990 8.8 Bl
003 9.5 Ht
008 9.8 Ht
013 10.1 dK
014 10.0 Ht
020 10.3 dK
027 10.7 dK
036 10.8 dK

V Leo
095421
986 12.1 Ks

RR Car
095458
973 7.4 En
979 7.5 Ht
980 7.7 En
984 7.3 Ht
987 7.7 En
989 7.4 Ht
995 7.4 Ht
003 7.6 Ht
008 7.6 Ht
014 7.8 Ht

RY Car
095563
973 11.7 En
979 12.2 Ht
980 12.0 En
984 12.5 Ht
987 12.0 En
989 12.7 Ht
990 12.2 Bl
003 12.9 Ht
008 13.0 Ht
014 13.1 Ht

S Car
100661
973 8.0 En
979 7.9 Ht
980 8.0 En
984 7.8 Ht
987 7.5 En
989 7.5 Ht
990 7.5 Bl
995 7.1 Ht
003 6.8 Ht
008 6.4 Ht
013 6.3 dK
014 6.0 Ht
020 6.2 dK
027 6.1 dK
036 6.0 dK

U UMa
100860
987 6.8 Hr
004 6.3 Ks
026 6.4 Lt
047 6.5 Lt

Z Car
101058a
984[12.3 Ht
990[12.3 Bl
003[12.6 Ht
014[12.3 Ht

W Vel
101153
979 12.0 Ht
984 12.2 Ht
987 12.0 En
989 12.2 Ht
990 12.0 Bl
003 11.7 Ht
008 10.9 Ht
014 10.4 Ht

RZ Car
103270
984[13.6 Ht
003[13.6 Ht
014[13.6 Ht

R UMa
103769
963 7.0 So
004 11.0 Ks
007 10.5 Ah
009 10.3 Ah
009 11.3 Hk
012 10.3 Hk
018 9.1 Sz
031 7.8 Hm
032 7.8 Hm
032 7.4 Rb
032 8.3 Cm
032 7.8 Jo
032 7.7 Dl
033 7.9 Dl
033 7.8 Hm
034 7.9 Ba
035 7.8 Mc
036 7.5 Bu
038 7.7 Dl
038 7.8 Fs
038 7.7 Jo
038 7.7 Kn
038 7.4 Hf
038 7.7 Wd
038 7.6 Hm
039 7.7 Td
039 7.9 Mc
040 7.8 Mc
041 7.6 Hm
041 7.6 Td
042 7.4 Ch
043 7.5 Td
043 7.0 So
043 7.6 Se
043 7.9 Cm
044 7.5 Hm
044 7.5 Mc
045 7.6 Se
046 7.5 Mc
047 7.5 Jo
050 7.5 Dl
050 7.2 Mc
051 7.4 Mc
051 7.3 Bu
052 7.1 Gy
052 7.3 Hf
052 7.4 Hs
052 7.5 Td
053 7.3 Dl
054 7.2 Dl
056 7.7 Td
056 7.3 Wd
056 6.8 Rb
057 7.6 Td
057 7.3 Dl
057 7.3 Hs
062 7.5 Hb

RS Hya
104628
990[12.5 Bl

W Leo
104814
986 13.5 Ks

S Leo
110506
986 10.8 Ks
009 10.2 Bj

RY Car
111561
979[13.1 Ht
990[13.1 Bl
014[13.1 Ht

RS Cen
111661
973 8.9 Cm
977 9.0 En
979 8.9 Ht
980 9.0 En
984 8.5 Ht
987 9.0 En
989 8.5 Ht
990 8.3 Bl
003 8.4 Ht
008 8.6 Ht
013 8.9 dK
014 8.8 Ht
020 9.0 dK
027 9.7 dK
040 10.6 dK

ST UMa
112245
004 6.6 Ks

X Cen
114441
974[13.1 En
985[13.1 Ht
990 13.1 Bl
012 12.5 Ht

AD Cen
114858
979 9.6 Ht
984 9.6 Ht
989 9.4 Ht
003 9.4 Ht
008 9.4 Ht
014 9.3 Ht

W Cen
115058
979 12.6 Ht
980 12.6 En
984 12.2 Ht
987 12.6 En
989 12.4 Ht
990 12.1 Bl
003 11.9 Ht
008 11.5 Ht
014 11.2 Ht
020 9.9 dK
027 9.1 dK
040 9.0 dK

Z UMa
115158
019 7.9 Kp
020 7.8 Kp
030 6.8 Rb
032 7.0 Rb
033 6.8 Rb
035 6.7 Bu
035 6.5 Kn
038 6.9 Hf
038 6.8 Rb
039 6.7 Rb
039 7.2 Se

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
Z UMA			T UMA			R VIR			S UMA			R HYA			V UMI		
115158			123160			123307			123961			*132422*			133674		
040	6.7	Bu	963	8.9	So	947	10.6	Si	034	11.3	Pt	005	5.1	Ch	004	7.6	Ks
041	7.1	Se	965	8.7	Ma	947	10.6	Hq	034	11.6	Wp	006	4.6	Df	020	7.8	Ks
041	6.8	Rb	982	9.3	So	986	8.4	Mw	036	11.5	Hv	009	4.4	Df	031	7.8	Ks
043	7.1	Se	983	9.8	So	013	6.8	Ks	036	11.5	Bc	012	4.3	Df	RT CEN		
044	7.1	Se	984	9.3	Ah	032	7.9	Rc	037	11.5	Kn	012	4.5	Ht	*134236*		
047	6.5	Rb	985	9.4	Ah	035	8.3	Rc	037	11.5	Wp	013	4.6	dK	974	10.4	En
048	6.6	Rb	988	9.2	Wg	RS UMA			038	11.6	Dl	015	4.2	Df	979	10.8	Ht
050	6.4	Rb	990	9.6	Ah	123459			038	11.9	Ma	019	4.2	Df	983	10.0	En
050	6.9	Bu	993	9.6	Ah	960	14.0	Ma	038	11.5	Hf	020	4.7	dK	985	9.8	Ht
052	6.7	Hf	995	9.9	Ah	963	13.5	So	038	11.4	Wd	022	4.2	Df	990	9.7	Ht
054	6.8	Hf	997	10.0	Ah	983	13.1	So	039	11.3	Wp	027	5.0	dK	990	9.8	Bl
056	6.9	Rb	004	9.9	Ks	004	14.6	Ks	039	12.1	So	034	5.4	Ch	004	9.8	Ht
			007	10.1	Ah	016	[13.2	Ry	039	11.2	Jo	041	5.5	dK	012	9.7	Ht
R COM			009	10.3	Ah	020	14.0	Ks	039	11.3	Mc	S VIR			R CVN		
115919			009	10.1	Hk	021	13.7	Ry	043	11.9	So	*132706*			134440		
006	13.0	Ks	013	10.4	Ma	032	13.3	Cm	047	10.7	Jo	974	12.2	En	975	9.9	Si
013	13.1	Ks	018	10.0	Hv	034	13.5	Pt	050	11.1	Mc	983	11.9	En	984	10.0	Ah
032	[12.2	Bj	018	10.7	Wg	035	12.2	Md	050	11.3	Dl	004	11.5	Ht	989	9.9	Fc
R CRV			018	10.0	Bc	038	12.7	Ma	052	11.3	Gy	005	11.9	Ch	990	9.8	Ah
121418			018	10.1	Ks	039	13.5	So	053	11.1	Dl	009	11.7	Bj	993	9.6	Ah
914	8.2	Hc	019	10.0	Hv	043	12.9	So	RU VIR			011	10.9	Ss	995	9.6	Ah
914	8.5	Si	019	10.1	Cl	S UMA			124204			012	11.5	Ht	997	9.5	Ah
920	8.5	Si	019	10.8	Bc	123961			033	[12.3	Bj	013	11.3	Ks	003	9.6	Fc
T CVN			019	10.0	Ma	920	8.0	Si	RV VIR			033	9.7	Bj	005	9.6	Ah
122532			020	10.0	Ks	955	8.3	Ma	*130212*			034	9.7	Ch	006	9.6	Wh
000	10.3	Fc	022	10.2	Md	960	8.6	Ma	991	[13.3	Fc	034	9.5	Pt	007	9.6	Ah
004	9.7	Ks	027	10.4	Cl	963	8.8	So	U OCT			RV CEN			009	9.6	Ah
009	10.0	Bj	029	10.7	Md	965	8.3	Ma	*132183*			*133155*			013	8.9	Ks
013	10.2	Ks	032	10.7	Jo	982	10.1	So	973	9.0	En	974	8.2	En	018	9.3	Sz
029	9.9	Md	032	11.0	Cm	984	9.5	Ah	980	9.4	Ht	979	7.8	Ht	020	9.3	Kn
032	10.2	Bj	032	10.9	Ra	985	9.6	Ah	983	9.4	En	983	8.1	En	032	8.7	Jo
032	10.1	Rc	033	10.3	Rc	988	10.5	Wg	985	9.9	Ht	984	7.8	Ht	034	8.5	Ch
033	10.1	Hi	033	11.1	Rb	990	10.3	Ah	990	10.3	Ht	989	7.8	Ht	034	8.4	Pt
034	10.4	Ch	033	11.0	Dl	993	10.3	Ah	990	10.2	Bl	990	8.0	Bl	037	8.5	Bu
034	10.3	Pt	033	11.2	Wg	995	10.5	Ah	004	10.8	Ht	003	7.8	Ht	038	8.6	Jo
035	10.1	Md	034	10.7	Ch	004	10.5	Ks	012	11.4	Ht	008	7.8	Ht	038	8.5	Hf
049	9.9	Md	034	11.3	Pt	007	11.3	Ah	013	11.4	dK	013	7.9	dK	042	8.5	Fc
Y VIR			035	11.2	Md	009	11.4	Ah	020	11.5	dK	014	7.6	Ht	044	8.4	Jo
122803			036	10.8	Hv	009	11.0	Hk	027	[11.5	dK	020	7.8	dK	048	8.2	Jo
012	[12.0	Bj	037	11.2	Kn	012	11.3	Hk	V VIR			027	7.5	dK	052	8.3	Hf
U CEN			038	11.5	Dl	013	11.5	Ma	*132202*			040	7.4	dK	056	8.2	Wd
122854			038	11.3	Ma	018	11.0	Hv	009	10.4	Bj	T UMI			RX CEN		
979	12.5	Ht	038	11.0	Hf	018	11.5	Wg	031	12.3	Bj	133273			*134536*		
984	12.5	Ht	038	11.0	Wd	018	11.3	Bc	R HYA			004	10.4	Ks	974	8.8	En
989	12.4	Ht	039	11.0	Jo	019	11.3	Hv	*132422*			020	9.4	Ks	979	9.3	Ht
990	11.8	Bl	039	10.4	So	019	11.3	Cl	973	5.9	En	031	10.2	Ks	983	9.0	En
003	10.0	Ht	042	11.2	Fc	019	11.3	Bc	974	5.6	En	033	9.5	Jo	985	9.7	Ht
008	10.0	Ht	043	11.0	So	019	10.9	Ma	979	5.6	Df	033	10.1	Sf	990	10.0	Ht
013	9.9	dK	045	12.0	Md	027	11.2	Cl	980	5.7	Ht	038	9.5	Jo	990	9.5	Bl
014	9.8	Ht	047	12.2	Jo	027	11.5	Wp	983	5.1	En	038	10.1	Kn	004	10.0	Ht
020	9.3	dK	050	11.8	Dl	031	11.4	Wa	985	5.3	Ht	038	9.8	Hf	012	11.2	Ht
027	8.8	dK	052	11.4	Gy	031	11.5	Wp	986	5.0	Df	042	9.9	Bu	T APS		
040	8.5	dK	053	11.8	Dl	032	11.0	Jo	987	4.9	En	042	10.6	Fc	*134677*		
T UMA			R VIR			032	11.5	Ra	989	4.8	En	043	10.5	Sf	974	12.7	En
123160			123307			032	11.9	Cm	990	5.1	Ht	044	9.9	Jo	980	12.9	Ht
920	8.1	Si	914	8.9	Hc	033	11.6	Rb	990	5.0	Bl	052	10.6	Hf	983	12.0	En
955	8.6	Ma	914	9.4	Si	033	12.0	Wg	003	4.7	Df	052	10.8	Gy	985	12.7	Ht
960	8.6	Ma	920	9.7	Si	033	11.5	Dl	004	4.9	Ht				990	12.2	Ht

Variable Star Observations Received During September, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
T Aps			U UMi			V Boo			V Boo			R Boo			R Boo		
134677			141567			142539a			142539a			143227			143227		
991	11.5	Bl	018	9.9	Ks	984	8.8	Ah	056	8.2	Hm	982	7.2	Bs	008	7.5	Bs
004	10.8	Ht	019	10.6	Ma	989	8.7	Fc	057	8.1	Hm	984	7.9	Ah	009	8.1	Md
012	9.7	Ht	019	10.3	Cl	990	8.8	Ah	061	8.1	Hm	985	7.9	Ah	009	7.5	Hv
RR Vir			020	10.4	Md	991	8.8	Bk	062	7.8	Hb	985	7.1	Jo	009	7.9	Hm
135908			020	10.1	Kn	993	9.0	Ah	R Cam			985	7.3	Cm	009	8.0	Ah
987	13.3	Ap	020	10.3	Hi	995	8.9	Ah	142584			985	7.4	Hv	009	7.9	Ks
012[	13.1	Bj	024	10.3	Md	997	8.9	Ah	989	11.2	Fc	986	7.4	Hv	009	7.8	Bj
033[	12.8	Bj	027	10.0	Cl	001	8.7	Sn	990	10.9	Ch	986	7.9	Mw	010	8.1	Dl
Z Boo			029	10.3	Md	003	8.2	Sn	020	8.9	Kn	987	7.8	Hm	010	8.0	Pt
140113			030	9.9	Es	003	8.7	Fc	031	8.5	Hi	987	7.2	Sz	010	7.8	Hm
955	13.2	Ma	031	10.0	Hi	003	8.4	Ku	031	8.5	Ks	987	7.5	Bc	011	8.5	Dl
960	13.2	Ma	031	9.4	Ks	004	8.6	Sn	032	8.4	Jo	988	7.7	Hm	011	8.2	Cm
987	14.2	Ap	032	10.0	Ra	006	9.2	Wh	033	8.3	Ch	988	7.5	Bc	011	8.1	Hm
013[	13.8	Ma	032	10.2	Jo	007	8.7	Sn	033	8.7	Br	988	7.4	Hv	011	7.7	Ss
Z Vir			033	10.1	Md	007	8.4	Ah	034	8.7	Hi	989	7.4	Hv	012	7.7	Ss
140512			033	9.9	Sf	009	8.7	Ah	037	8.8	Fc	989	7.2	Bu	012	7.6	Bc
991[	13.8	Fc	034	9.8	Pt	013	8.7	Ks	038	8.5	Jo	989	7.2	Fc	012	7.9	Hm
012[	13.2	Bj	034	9.7	Md	018	8.4	Kn	041	9.1	Hf	990	7.8	Ah	012	7.6	Bc
044[	13.8	Bj	034	9.9	Es	018	8.5	Dh	042	8.8	Fc	990	7.4	Bc	013	7.6	Hv
RU Hya			037	9.9	Fc	018	8.7	Ks	043	8.7	Wd	990	7.9	Kp	013	8.0	Ks
140528			038	9.8	Md	020	8.2	Kn	044	8.4	Jo	990	7.2	Hv	013	8.1	Mw
990	11.4	Ht	038	9.5	Es	028	8.7	Dh	045	8.6	Fc	990	7.5	Hf	014	7.8	Bc
991	11.0	Bl	038	9.7	Jo	031	8.4	Hm	048	8.3	Jo	992	7.5	Bc	014	8.3	Wd
004	12.0	Ht	038	10.2	Ma	032	8.2	Jo	052	9.1	Hf	992	7.3	Hv	014	7.8	Hv
012	12.4	Ht	038	9.7	Hf	032	8.3	Hm	056	8.4	Wd	992	7.8	Ah	014	8.2	Sh
R Cen			038	10.0	Hi	033	8.2	Ch	R Boo			993	7.2	Hv	014	8.2	Hf
140959			042	9.6	Cl	033	8.5	Sx	143227			994	7.5	Sq	015	8.0	Bc
973	7.8	En	042	9.8	Fc	033	8.6	Sf	935	10.6	Ch	995	7.8	Ah	015	8.5	Kp
979	8.5	Ht	043	9.7	Sf	033	8.4	Hm	940	10.0	Ra	996	7.4	Bc	015	8.0	Jo
983	7.5	En	044	9.7	Jo	034	8.7	Dh	947	9.5	Pt	996	7.2	Hv	015	8.0	Hv
984	8.5	Ht	044	9.4	Md	034	8.5	Pt	950	8.9	Sx	997	7.8	Ah	015	7.8	Sq
986	8.8	Df	045	9.4	Md	035	8.8	Dh	954	9.5	Ap	999	7.4	Bc	016	8.1	Md
989	8.6	Ht	045	9.7	Fc	035	8.4	Mc	964	8.5	Es	999	7.4	Hv	016	8.4	Hm
991	7.8	Bl	048	9.3	Jo	036	8.5	Kn	965	8.6	Cm	999	7.9	Hm	017	8.4	Md
002	8.1	Df	051	9.3	Md	036	8.5	Hk	965	8.9	Hf	000	7.7	Hm	018	8.0	Hb
003	8.3	Ht	052	9.7	Hf	036	8.8	Se	965	8.0	Jo	000	7.5	Bc	018	8.0	Bc
008	7.4	Ht	052	9.3	Gy	036	8.5	Bu	973	8.0	Md	000	7.5	Hv	018	7.8	Hv
013	7.1	Df	056	9.7	Wd	037	8.5	Bk	973	8.0	Sx	001	7.4	Hv	018	8.2	Sz
013	6.6	dK	S Boo			038	8.2	Jo	974	8.0	Kp	001	7.7	Hf	019	8.0	Bc
014	7.6	Ht	141954			038	8.2	Hf	974	7.6	Pt	002	7.4	Hv	019	8.2	Kp
017	6.6	Df	989[	12.5	Fc	038	8.3	Hm	976	8.3	Hf	002	7.5	Jo	019	8.6	Rb
020	6.4	dK	013	13.4	Ks	039	8.2	Mc	976	8.1	Ah	002	7.4	Hf	019	8.5	Dl
022	6.0	Df	014	13.4	Ks	039	8.7	Wg	977	8.7	Dh	002	7.2	Wd	019	8.3	Hm
025	5.8	Df	018	13.2	Ks	040	8.8	Se	977	7.7	Jo	002	7.7	Hm	020	8.3	Kp
027	6.2	dK	020	13.4	Ks	041	8.2	Hm	978	7.2	Bc	003	7.2	Hb	020	8.4	Hm
040	6.0	dK	033	12.4	Ch	042	8.6	Sq	978	7.2	Hv	003	7.5	Bc	021	8.5	Sx
U UMi			037	12.7	Fc	042	8.8	Dh	978	7.9	Md	003	7.5	Hv	023	8.2	Jo
141567			042[	13.3	Fc	042	8.6	Fc	979	7.6	Sq	003	8.0	Fc	024	8.5	Md
955	11.4	Ma	052[	12.5	Gy	043	8.7	Dh	979	7.5	Bc	004	7.4	Bc	028	8.7	Md
960	11.1	Ma	RS Vir			044	8.0	Jo	979	7.5	Hv	004	7.4	Hv	029	8.9	Hv
984	10.9	Ah	142205			044	8.1	Mc	979	7.6	Bu	005	7.8	Bu	030	8.6	Es
989	10.9	Fc	989	12.0	Fc	044	8.2	Hm	980	7.0	Hb	005	7.9	Ah	031	8.7	Wd
990	10.8	Ah	009	9.3	Bj	045	8.8	Se	980	7.5	Hv	006	7.4	Hv	031	8.8	Hm
995	10.6	Ah	013	8.6	Ks	045	8.3	Ks	980	7.5	Hf	006	7.6	Sq	032	8.8	Hm
007	10.5	Ah	018	8.7	Ks	048	7.8	Jo	980	7.5	Wd	007	7.4	Hv	032	8.9	Bc
009	10.6	Ah	033	8.3	Bj	051	8.0	Mc	982	7.4	Bc	007	7.9	Ah	032	8.7	Jo
013	10.5	Ma	034	8.6	Ba	052	8.2	Hf	982	7.4	Hv	008	7.4	Jo	032	8.6	Bj
014	10.2	Ks				056	8.0	Wd	982	7.4	Jo	008	8.4	Je	033	9.2	Ch

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
R Boo			S Lup			Y Lup			T Lib			S CrB			X Lib		
143227			*144646a*			*145254*			*150519*			151731			*153020*		
033	8.8	Hm	930	12.2	Ht	974	13.0	En	974[	12.0	Pt	036	8.5	Bc	991	12.7	Fc
034	8.8	Pt	945	12.5	En	983	13.7	En	983	12.8	Fc	038	8.5	Dl	W Lib		
035	8.7	Es	952	12.4	En	984	13.0	Ht	991	12.0	Fc	038	8.2	Jo	*153215*		
036	9.2	Bc	958	12.0	Ht	003	12.8	Ht	006	11.4	Wu	038	8.6	Hf	991	12.6	Fc
036	9.2	Hv	960	12.2	En	014[	12.8	Ht	007	11.6	Bj	038	8.4	Hh	S UMi		
037	9.0	Bu	974	11.6	En	S Aps			033	11.7	Bj	038	8.1	Rl	153378		
038	8.9	Hm	975	11.2	Ht	*145971*			Y Lib			038	8.7	Hm	989	11.2	Fc
038	8.8	Jo	980	10.6	Ht	919	13.4	Ht	*150605*			039	8.3	Mc	020	12.5	Hi
038	9.2	Md	983	10.8	En	925	12.7	Bl	947	12.0	Pt	040	7.8	Pt	020	12.0	Ks
038	9.3	Hf	985	10.6	Ht	926	13.3	Ht	964	8.9	Es	041	8.1	Sq	031	12.7	Hi
041	9.1	Hm	990	10.2	Ht	926	12.9	Sl	974	8.5	Pt	042	7.8	Mc	031	11.9	Ks
041	9.5	Sq	008	9.7	Ht	930	13.1	Ht	976	8.3	Kn	042	7.6	Bu	032	11.5	Jo
044	9.0	Hm	X Lup			930	12.5	Bl	003	7.7	Fc	043	8.0	Sf	033	11.8	Dl
044	9.0	Jo	*144646b*			942	12.2	Bl	006	7.5	SS	044	7.4	Dt	037	12.6	Fc
045	9.4	Bc	926[	12.1	Ht	943	12.2	En	007	7.6	SS	044	7.5	Jo	038	12.9	Hi
045	9.7	Ks	958[	12.1	Ht	944	11.9	Ht	007	8.0	Bj	045	7.9	Hv	038	12.3	Hf
045	9.6	Md	983[	12.1	En	945	11.9	En	012	7.6	SS	045	7.9	Bc	038	12.7	Kn
045	9.4	Hv	985[	12.1	Ht	947	12.0	Bl	018	8.3	Lt	045	8.1	Je	038	11.7	Jo
048	9.1	Jo	U Boo			948	12.2	Bl	023	8.5	Cl	045	7.4	SS	038	12.0	Dl
049	9.9	Md	144918			950	11.7	En	030	8.8	Es	046	7.2	Cl	040	11.5	Pt
052	9.9	Hf	920	10.6	Fn	951	12.0	Ht	031	8.5	Bj	048	6.5	Jo	042	12.7	Fc
054	10.7	Cm	931	10.8	Fc	952	11.5	En	038	9.4	Hf	049	7.3	Dt	044	11.7	Jo
V Lib			932	10.4	Fn	955	11.9	Ht	S Lib			050	6.9	Dl	045	13.2	Fc
143417			947	10.3	Fn	958	11.9	Ht	*151520*			050	7.3	Mc	052[	12.5	Gy
931[	12.0	Fc	949	10.2	Ch	959	11.2	En	009	9.0	Bj	051	7.2	Mc	U Lib		
954	10.1	Ap	953	10.4	Fn	959	12.0	Sl	031	8.5	Bj	052	7.0	Hf	*153620a*		
956	10.3	Fc	958	10.3	Cl	959	11.4	Bl	S Ser			052	6.7	Ba	011	9.7	Bj
968	9.3	Be	976	10.7	Fn	960	11.0	En	151714			052	7.1	Hs	035	10.0	Bj
976	9.4	Jo	977	10.3	Cl	961	10.9	En	955	13.3	Ma	053	7.0	Dl	T Nor		
979	9.3	Jo	978	10.8	Gy	963	10.8	En	960	13.2	Ma	053	6.9	Cm	*153654*		
979	9.5	Hf	981	10.9	Fn	973	10.9	Ht	991	12.3	Fc	054	7.0	Dl	974	12.8	En
980	9.5	Wd	982	10.8	Jo	973	10.8	En	007	11.9	Bj	RS Lib			983	13.1	En
984	9.3	Jo	985	11.0	Jo	974	10.8	En	013	11.5	Ma	*151822*			014	12.6	Ht
988	9.0	Jo	992	10.7	Cm	977	11.1	Sl	029	11.9	Es	974	8.9	En	040	10.9	dK
990	9.5	Cm	001	10.5	Jo	977	10.8	En	033	11.6	Bj	980	8.1	Ht	RR CrB		
990	9.5	Hf	006	11.3	Cm	979	10.8	Ht	035	11.8	Fc	983	7.9	En	153738		
002	9.8	Cm	010	10.7	Jo	983	10.9	En	038	11.6	Jo	985	8.0	Ht	018	7.7	Ks
006	10.5	Hf	012	11.7	Bj	984	10.8	En	039	11.5	Ma	989	8.0	Fc	R CrB		
007	10.3	Bj	015	10.6	Jo	989	10.6	En	040	12.0	Es	990	8.0	Ht	154428		
031	12.2	Bj	032	11.9	Bj	989	10.9	Ht	041	11.5	Kn	991	7.5	Fc	913	9.4	Si
RW Boo			038	11.9	Jo	991	10.8	Bl	044	11.0	Jo	003	7.6	Fc	914	9.3	Hc
143632			042	12.4	Fc	993	10.7	En	048	10.5	Jo	012	7.9	Ht	918	9.4	Si
887	8.0	Lt	044	12.1	Jo	003	10.4	Ht	052	10.9	Es	013	8.1	dK	925	8.8	Si
898	7.9	Lt	045	12.3	Fc	008	10.5	Ht	S CrB			020	8.3	dK	949	8.3	Si
925	8.0	Lt	Y Lup			RT Lib			151731			027	8.7	dK	954	7.6	Si
933	8.0	Lt	*145254*			*150018*			008	11.8	SS	040	9.5	dK	955	8.0	Hr
946	8.0	Lt	925	10.8	Bl	945	11.3	Fc	014	10.9	Ks	RU Lib			955	7.4	Ss
963	7.9	Lt	926	11.0	Ht	947	11.7	Pt	018	10.9	SS	*152714*			955	8.1	Si
RY Boo			930	11.0	Ht	949	11.4	Ch	018	11.3	Ks	991	11.5	Fc	955	7.6	Hq
144523			930	10.8	Bl	956	11.9	Fc	019	10.3	Kp	040[	13.0	Pt	955	7.6	By
887	7.2	Lt	942	11.3	Bl	966	12.3	Fc	020	10.3	Kp	R Nor			975	7.4	Si
898	7.5	Lt	945	12.4	Ht	974	13.5	Pt	032	8.9	Rl	*152849*			982	7.5	Hr
925	7.6	Lt	945	11.7	En	991[	13.2	Fc	033	8.9	Sx	974	10.9	En	984	7.2	Ah
933	7.5	Lt	948	11.7	Bl	010[	12.9	Pt	034	8.9	Ba	979	11.5	Ht	985	7.2	Ah
946	7.4	Lt	951	12.2	Ht	040[	12.9	Pt	034	9.0	Ch	983	11.0	En	985	6.8	Si
963	7.4	Lt	952	12.0	En	T Lib			034	9.0	Jo	984	11.4	Ht	987	7.4	Fc
			958	12.3	Ht	*150519*			035	7.8	Dt	989	11.7	Ht	987	6.9	Ku
			960	12.2	En	949[	13.2	Ch	036	8.5	Hv	008	12.2	Ht	987	7.3	Hr

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
	R CrB			R CrB			R CrB			R CrB			R CrB			R Ser	
	154428			154428			154428			154428			154428			154615	
988	7.0	Ku	009	6.5	SS	029	7.0	Bc	038	6.8	Ar	046	7.1	Rb	024	11.9	Es
989	7.0	Fc	009	6.7	Ra	029	6.4	Ar	038	7.0	SC	046	6.9	Hm	028	11.5	Es
989	7.3	Hr	010	7.0	Dt	029	6.8	Ku	038	7.1	Rb	047	7.1	Rb	032	11.8	Ks
990	6.9	Si	010	6.7	Ku	030	6.7	SS	038	7.2	Sa	048	7.1	Rb	032	11.8	Rb
990	7.2	Ch	010	6.8	Kv	030	7.1	Rb	038	6.8	Hk	048	6.3	Jo	033	11.4	Es
990	7.0	Fc	011	6.7	Ra	031	6.9	Wd	038	6.5	Jo	049	6.9	Dt	033	11.5	Bj
990	6.9	Ah	011	7.0	Wh	031	7.0	Ba	038	6.6	SS	050	7.1	Rb	035	11.8	Md
991	7.1	Bk	011	6.8	Ss	031	7.2	Hm	038	6.8	Pt	050	6.9	Bu	038	11.6	Jo
991	7.4	Hr	012	6.9	Hk	031	6.7	Ks	038	6.9	Ra	050	6.5	Pt	039	11.5	Fc
991	7.0	Fc	012	6.8	Ku	032	6.8	Ks	038	7.2	Hm	050	6.9	Dl	039	11.4	Es
992	7.2	Sn	012	6.7	SS	032	7.2	Hm	038	7.0	Dl	051	6.5	Pt	040	11.4	Pt
992	6.9	Ah	013	6.4	Ks	032	7.1	Kg	038	6.9	Fc	052	6.9	Hf	044	11.3	Jo
992	6.9	SS	013	7.0	Bk	032	7.1	Dl	039	7.0	Td	052	6.8	Gy	045	11.5	Ks
992	7.0	Ku	013	6.5	SS	032	6.9	Ra	039	6.9	Fc	052	7.1	Td	048	11.0	Jo
992	7.4	Hr	014	6.3	Ks	032	7.0	Rl	039	7.0	Wa	052	7.1	Hs	049	11.7	Md
993	6.9	SS	014	6.5	SS	032	7.2	Sx	040	6.6	SS	052	6.9	Ba	049	11.2	Es
994	7.2	Ra	015	6.8	Ku	032	7.0	Bc	040	6.6	Pt	053	7.0	Cm	052	11.1	Es
994	7.1	Fc	016	6.7	SS	032	7.1	Pb	040	7.0	Bu	053	7.0	Hm		V CrB	
994	7.0	Ku	016	7.4	Sa	032	7.1	Mg	040	7.0	Ku	053	6.9	Dl		154639	
994	7.0	Ah	017	6.7	SS	032	6.5	Jo	040	7.0	Ba	054	6.9	Hf	983	8.3	So
994	6.9	SS	018	6.6	SS	032	7.1	BT	040	7.0	Dh	054	7.0	Hm	989	8.3	Fc
995	7.1	Ah	018	6.6	Sz	032	6.8	Wa	041	7.3	Hm	054	6.9	Dl	997	7.8	Ku
996	6.9	Ku	018	6.7	SE	033	6.9	Hf	041	7.1	Rb	055	7.0	Sh	999	7.3	Fc
997	7.0	Ah	018	7.0	Ku	033	7.1	Dl	041	7.0	Sq	056	7.1	Rb	000	7.5	Ku
997	6.9	Ku	018	7.0	Dh	033	7.1	Rb	041	7.0	Hf	056	7.0	Wd	002	7.5	Ku
998	7.4	Hr	018	7.1	Hv	033	7.2	Hm	041	7.0	Bc	056	7.0	Hm	003	7.6	Fc
998	6.9	Ku	018	7.1	Bc	033	7.2	Ch	041	6.9	An	056	6.9	Ba	003	7.7	Hk
999	6.8	Fc	018	7.0	Lf	034	6.7	Ba	041	7.0	Hv	056	6.4	Pt	003	7.5	Ku
999	6.8	Ra	018	6.2	Ks	034	7.0	Dh	041	7.4	Cm	057	6.9	Hs	004	7.7	Hk
999	6.8	Pb	019	6.9	SE	034	6.9	Ku	041	7.0	SC	057	7.0	Dl	004	7.5	Ku
999	6.7	Kv	019	7.4	Kp	034	6.4	Jo	041	7.0	Td	059	6.4	Pt	007	7.5	Ku
999	6.9	Ku	019	7.0	Bc	034	6.7	Pt	042	6.9	L	061	7.1	Hm	009	7.3	Ks
000	6.9	Ku	019	7.0	Hv	035	6.7	SS	042	6.9	Fc	062	7.0	Hb	010	7.5	Ku
000	7.1	Hr	019	6.8	SS	035	6.8	Ar	042	6.8	Pt		X CrB		010	7.9	Wh
000	7.0	Sn	020	7.3	Sa	035	6.8	Dh	042	6.6	Ar		154536		012	7.5	Ku
000	7.0	Pb	020	7.3	Kp	035	6.9	Ku	042	6.8	Dh	955	12.8	Ma	012	7.7	Hk
001	6.8	Ra	020	7.1	Hf	035	7.0	Dt	042	7.0	An	960	12.2	Ma	014	7.1	Ks
001	6.4	SS	021	7.0	Rl	035	7.0	Cm	043	7.0	Sa	999	9.7	Fc	015	7.4	Ku
002	6.8	Ku	021	7.1	Je	035	7.0	Bu	043	7.3	Bc	003	9.3	Fc	018	7.6	Ku
002	6.5	SS	021	6.6	SS	035	7.1	Kg	043	7.0	Dh	013	9.0	Ma	018	7.7	Dh
003	6.9	Fc	022	6.7	Ra	035	6.8	Fc	043	7.1	Kg	020	9.0	Hi	018	6.9	Ks
003	6.8	Ku	022	7.1	An	036	7.2	Bc	044	6.7	SE	031	9.1	Hi	019	7.9	Hh
003	6.6	Sn	022	6.5	SS	036	7.1	Sx	044	6.8	Fc	034	9.0	Jo	020	7.7	Hi
004	6.5	Ks	023	7.0	Ku	036	7.2	Hv	044	6.6	SS	038	9.2	Jo	026	7.4	Ku
004	6.7	Ku	023	6.5	SS	036	6.9	Ar	044	6.6	Jo	038	9.2	Hi	026	8.2	Wp
004	6.8	Sn	024	7.1	Je	036	7.0	Ku	044	7.0	Dt	039	9.2	Ma	026	8.0	Wa
005	6.9	Ah	024	7.1	Rb	036	6.7	SE	044	7.2	Hm	040	9.1	Pt	027	6.5	Ks
005	7.0	Ch	025	6.8	Bc	036	6.9	Ra	045	7.0	Bk	042	9.2	Fc	027	7.4	Es
006	6.5	SS	026	6.8	Ar	036	6.7	Fc	045	7.1	Je	044	9.5	Jo	029	7.4	Md
007	7.1	Ah	026	7.0	Wa	036	6.7	SS	045	6.7	Ks	048	9.3	Jo	030	7.4	Es
007	7.0	Hr	026	6.9	Ku	037	6.7	SS	045	7.3	Bc		R Ser		031	7.7	Hi
007	6.7	Sn	026	6.9	Wp	037	7.0	Fc	045	7.2	Hm		154615		032	7.6	Rb
007	6.7	SS	027	7.1	Rb	037	6.7	SE	045	7.3	Hv	955	11.6	Ss	032	7.3	Ra
008	6.5	SS	027	6.6	Ks	037	7.0	Bk	045	7.1	Fc	007	12.8	Bj	032	6.7	Ks
009	6.5	Ks	028	6.9	Bc	037	6.7	Ar	045	6.3	Ar	009	12.3	Ks	033	7.5	Es
009	7.0	Ah	028	6.7	Ar	038	7.0	Sx	045	6.7	SS	014	12.1	Ks	034	6.6	Ba
009	7.0	Dt	028	7.0	Dh	038	7.3	Rl	045	6.6	SE	018	11.9	Ks	034	7.3	Jo
009	6.7	Kv	029	7.0	Hv	038	7.0	Hf	046	7.0	Dh	020	12.0	Ks	035	7.6	Mc

Variable Star Observations Received During September, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
V CrB			RZ Sco			U Ser			RU Her			U Her			U Her		
154639			*155823*			160210			160625			162119			162119		
036	7.8	Md	031	9.3	Rc	037	8.9	Fc	018	11.1	SS	984	8.9	Ah	036	10.0	Kt
036	7.7	Ku	033	9.5	Bj	038	9.3	Fs	022	11.5	SS	988	8.8	Ss	036	9.5	SS
038	7.4	Jo	037	9.5	Rc	038	9.5	Jo	032	11.6	Ks	989	9.0	Fc	037	9.6	SS
038	7.7	Hf	040	10.0	Pt	038	9.1	Hf	034	12.4	Jo	990	9.0	Ch	038	10.0	Fs
038	8.0	Hh	040	9.6	dK	039	9.4	Ma	036	11.9	SS	992	9.1	Ah	038	9.7	Jo
038	7.9	Hi	Z Sco			040	9.4	Pt	038	11.7	Wd	992	8.9	SS	038	10.0	Ke
039	7.8	Es	*160021*			042	9.0	Fc	039	11.6	Fc	993	8.7	SS	038	10.0	Hf
040	7.7	Es	955	9.1	Hq	044	9.4	Jo	039	12.3	Ma	995	9.3	Ah	038	9.6	Hm
040	7.0	Pt	955	9.0	Si	044	8.8	Lt	040	11.7	Pt	999	9.0	Fc	038	10.2	Fc
040	7.7	Mc	974	9.5	En	045	9.1	Hv	041	12.4	Br	001	8.8	SS	039	9.8	Fc
041	7.6	Sq	975	9.8	Si	045	9.1	Bc	045	12.2	SS	002	8.5	SS	039	9.6	Td
041	7.7	Md	980	9.3	Ht	045	8.8	Gc	045	11.6	Ks	002	8.8	Wh	040	10.2	Mc
042	7.8	Fc	983	9.3	En	048	9.3	Jo	053	12.6	Cm	006	8.9	SS	040	9.9	Pt
044	7.5	Jo	985	9.2	Ht	052	9.1	Hf	R Sco			007	9.4	Ah	041	9.6	Td
045	7.2	Ks	989	9.5	Kv	056	9.2	Wd	*161122a*			007	9.1	SS	042	10.3	Fc
045	8.0	Es	990	9.3	Ht	SX Her			980[	12.6	Ht	008	8.9	SS	043	9.7	Td
047	7.6	Md	999	9.4	Fc	160325			999[	12.8	Bj	008	9.3	Ss	043	10.3	Ca
048	7.3	Jo	012	9.5	Ht	993	8.8	Bk	042[	13.4	Bj	009	9.2	Ss	044	9.9	SS
049	7.7	Es	031	9.9	Rc	999	8.2	Fc	R Sco			009	9.0	Ah	044	10.0	Jo
051	7.8	Mc	037	10.0	Rc	017	8.4	Lt	*161122b*			009	9.1	Ks	045	10.0	SS
052	8.0	Hf	R Her			031	8.3	Wd	974	12.4	En	009	9.2	SS	045	9.8	Ks
052	8.1	Es	160118			034	8.2	Ba	980	12.6	Ht	012	9.6	SS	045	9.7	Bc
053	7.7	Md	955	9.7	Ss	034	8.3	Jo	983	13.0	En	014	9.5	SS	045	9.6	Hv
053	7.8	Cm	989	11.2	Fc	034	8.2	Pt	985	12.7	Ht	015	9.4	SS	046	10.6	Ke
056	7.7	Wd	007	12.3	Bj	035	8.1	Lt	040[	12.8	Pt	017	9.3	SS	050	10.4	Dl
R Lib			009	11.9	Ks	037	8.5	Bk	W CrB			018	9.2	SS	050	10.5	Mc
154715			014	12.2	Ks	038	8.5	Jo	161138			018	9.3	Ks	052	9.8	Td
987[	13.5	Ap	018	12.3	Ks	038	8.3	Hf	999	10.4	Fc	018	9.3	Hv	052	10.1	Hf
992[	13.9	Ap	027	12.9	Ks	038	8.2	Pt	018	10.9	Sz	018	9.3	Bc	053	10.2	Cm
007[	12.6	Bj	030	13.4	Es	038	8.3	Wd	027	11.6	Es	019	9.4	Hv	056	10.2	Wd
035[	13.5	Bj	032	13.2	Ks	038	8.2	Fc	031	11.6	Es	019	9.4	Bc	056	9.9	Td
RR Lib			034	13.3	Bj	040	8.3	Mc	033	12.2	Md	019	10.0	Ke	g Her		
155018			035	13.3	Es	040	8.3	Bu	036	11.8	Es	019	9.9	Kp	162542		
960	8.8	Ma	037	13.6	Fc	040	8.4	Pt	040	12.5	Jo	019	9.2	SS	018	5.3	Lt
999	7.6	Fc	039	13.4	Fc	041	8.1	Lt	040	11.8	Pt	020	10.0	Kp	023	5.3	Lt
003	8.2	Fc	040	13.1	Pt	042	8.3	Pt	042	12.3	Fc	021	9.7	Kt	030	5.0	Lt
013	8.7	Ma	045	13.5	Ks	046	8.1	Lt	043	12.4	Cm	021	9.3	SS	036	4.9	Lt
Z CrB			052[	13.1	Es	050	8.4	Mc	049	12.4	Md	022	9.3	SS	042	5.0	Lt
155229			U Ser			050	8.2	Pt	052	13.0	Es	028	9.6	Kt	052	5.3	Lt
030	12.9	Es	160210			051	8.1	Lt	053	12.4	Cm	029	9.8	Hv	SS Her		
035	13.1	Es	960	13.0	Ma	052	8.3	Hf	W Oph			030	9.8	Ke	162807		
045[	13.2	Fc	987	12.7	Ap	052	8.1	Ba	*161607*			030	9.6	SS	999	9.7	Fc
052	13.4	Es	994	12.5	Ap	053	8.3	Cm	991[	12.7	Fc	031	9.9	Hi	007	8.5	Wh
RZ Sco			999	11.6	Fc	056	8.2	Pt	V Oph			031	9.6	Wd	018	9.7	Bc
155823			013	10.3	Ma	059	8.1	Pt	*162112*			031	9.5	Hm	018	9.7	Hv
974	9.1	En	015	10.1	Ap	W Sco			009	8.7	Bj	032	9.3	Bc	019	9.5	Hv
983	9.0	En	018	9.4	Bc	*160519*			034	8.8	Jo	032	9.5	Jo	019	9.5	Bc
980	9.2	Ht	018	9.4	Hv	991[	13.8	Fc	038	8.5	Kn	032	9.8	Ks	029	10.0	Hv
985	9.2	Ht	019	9.3	Hv	RU Her			038	8.9	Hf	033	9.6	Sa	032	10.0	Bc
990	9.3	Ht	019	9.3	Bc	160625			039	8.4	Jo	033	10.0	Dl	033	11.2	Jo
999	8.8	Fc	029	9.2	Hv	960	10.4	Ma	040	7.7	Pt	033	9.6	Kt	033	11.1	Sf
009	8.5	Bj	032	9.2	Bc	999	10.7	Fc	044	8.3	Jo	033	10.0	Sf	036	11.0	Hv
012	9.1	Ht	033	9.1	Sx	006	11.5	SS	048	8.2	Jo	033	9.5	Hm	036	11.0	Bc
013	9.0	dK	034	9.7	Jo	007	11.4	SS	U Her			035	9.9	Ke	038	11.6	Jo
013	9.3	Mw	036	9.4	Bc	008	11.3	SS	162119			035	10.1	Kt	038	11.9	Rl
020	9.3	Kn	036	9.3	Lt	009	11.1	Ks	955	7.9	Ss	035	9.7	SS	040	11.4	Pt
020	9.1	dK	036	9.1	Bu	012	11.1	SS	978	8.5	Ss	036	9.5	Hv	044	12.0	Jo
027	9.4	dK	036	9.4	Hv	013	11.3	Ma				036	9.5	Bc			

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
SS HER			W HER			R DRA			TT OPH			RR SCO			TX OPH		
162807			163137			163266			164403			*165030a*			165905		
048	12.2	Jo	044	11.1	SS	038	7.3	Ma	038	9.7	Jo	004	11.2	Ht	038	9.8	Ar
S OPH			053	12.9	Cm	038	7.5	Kn	039	9.5	Md	012	10.6	Ht	039	9.9	Es
162816			R UMI			038	7.4	Hf	039	9.5	Rc	013	11.1	dK	040	10.1	Es
009	10.1	Bj	163172			038	7.2	Fc	040	10.0	Pt	020	9.6	dK	040	9.8	Pt
033	11.6	Mg	989	10.6	Fc	040	7.4	Pt	042	9.7	Rc	027	8.9	dK	041	9.9	Jo
034	11.8	Bj	018	10.5	Bc	041	7.3	Cl	042	9.9	Hk	040	7.9	dK	042	10.0	Hk
W HER			018	10.5	Hv	044	7.4	Jo	043	10.0	Hk	SS OPH			043	10.0	Fc
163137			019	10.5	Hv	052	7.5	Jo	043	10.0	Fc	*165202*			043	10.0	Hk
960	8.4	Ma	019	10.5	Bc	052	7.9	Hf	044	10.4	Jo	033	13.8	Es	044	10.2	Es
987	9.1	Ku	031	10.0	Ks	052	7.4	Gy	045	9.5	Md	035	13.7	Es	047	10.1	Rb
988	9.7	Ku	034	10.2	Jo	056	7.8	Wd	047	10.0	Md	050	13.6	Es	048	10.0	Jo
990	9.3	Ch	036	10.5	Bc	TX DRA			046	10.0	Rc	RV HER			049	10.3	Es
992	9.9	SS	036	10.5	Hv	163360			048	10.5	Jo	165631			050	10.4	Es
992	9.5	Kv	037	10.7	Fc	009	7.2	Ks	049	10.7	Md	989	15.1	Ap	051	10.4	Es
996	9.9	Kv	038	10.2	Rb	031	6.6	Ks	053	11.6	Md	033	14.3	Es	052	10.5	Es
996	9.9	Ky	038	10.5	Jo	S DRA			S HER			033	14.4	Mg	053	10.5	Es
997	10.0	Ky	038	10.5	Kn	164055			164715			036	14.3	Pf	053	10.1	Hf
997	9.9	Kv	038	10.4	Hf	009	8.4	Ks	992	10.1	Ah	039	14.1	So	055	10.5	Es
999	10.0	Kv	039	10.7	Mc	020	8.2	Ks	995	9.7	Ah	040	14.3	Es	056	10.6	Wp
999	9.9	Fc	041	10.3	Se	031	8.0	Ks	007	9.6	Ah	040	14.4	Pt	056	10.4	Wa
000	10.4	Sn	044	10.4	Jo	RR OPH			009	9.4	Ah	RT SCO			R OPH		
001	10.0	Sn	045	10.5	Bc	*164319*			019	9.6	Hh	*165636*			*170215*		
003	10.0	Ku	045	10.5	Hv	974	8.8	En	034	8.4	Jo	974	13.0	En	947	8.2	Hq
003	9.9	Kv	045	10.2	Fc	983	8.8	En	036	8.6	Lt	983	11.4	En	989	9.3	Kv
003	9.9	Ky	051	10.3	Mc	999	9.4	Fc	038	8.3	Jo	TX OPH			989	9.4	Fc
006	10.3	SS	052	10.2	Hf	009	9.3	Bj	038	8.6	Hf	165905			012	10.4	Bj
007	10.7	SS	052	10.6	Jo	033	10.8	Mg	038	8.9	Hh	985	9.9	Ah	031	11.8	Ks
008	10.6	SS	056	9.9	Wd	034	10.5	Bj	040	8.3	Pt	987	10.1	Fc	034	11.6	Bj
009	11.2	Kv	R DRA			038	11.0	Kn	040	8.5	Mc	993	10.2	Ah	035	11.4	Es
009	10.6	SS	163266			038	10.7	Fc	044	8.3	Jo	994	10.5	Fc	038	11.2	Fc
010	10.4	SS	965	11.2	Ma	040	10.9	Pt	047	8.0	Lt	995	10.2	Ah	039	12.4	Wg
013	11.0	Ma	984	9.3	Ah	TT OPH			048	8.0	Jo	002	10.5	Hk	RT HER		
017	10.6	SS	989	9.0	Fc	164403			050	8.4	Mc	003	10.5	Fc	170627		
018	10.8	SS	990	9.3	Ah	987	10.2	Fc	050	8.4	Dl	012	10.0	Hk	989	15.1	Ap
018	10.5	Bc	990	9.4	Ch	994	10.6	Fc	052	7.9	Hf	013	10.2	Bj	032	12.7	Pf
018	10.5	Hv	993	9.0	Ah	002	9.7	Hk	053	7.8	Dl	015	10.1	Hk	033	12.1	Mg
018	11.0	Sz	997	8.7	Ah	003	9.1	Fc	053	8.2	Cm	019	10.2	Ma	038	11.5	Jo
018	11.4	Dh	999	8.4	Fc	012	9.3	Hk	054	7.9	Dl	026	10.1	Wp	038	11.1	Hf
019	10.6	Bc	998	8.7	Ch	015	10.0	Hk	RS SCO			026	10.1	Wa	040	11.3	Pt
019	10.5	Hv	003	8.1	Hk	019	10.5	Kp	*164844*			029	10.0	Es	041	10.9	Kn
021	11.5	Kt	004	7.8	Fc	020	10.5	Kp	974	11.6	En	031	10.0	Es	044	10.8	Jo
022	10.8	SS	005	8.3	Ah	020	10.2	Md	980	11.8	Ht	031	10.1	Cm	045	10.6	Cl
023	11.5	Kt	007	8.2	Ah	031	9.7	Hi	983	11.6	En	032	9.8	Rb	052	9.7	Jo
035	11.5	Kt	009	8.1	Ah	031	9.5	Rc	985	11.8	Ht	032	9.9	Wa	Z OPH		
035	11.4	Dh	013	7.9	Ma	031	9.0	Fc	990	11.8	Ht	033	10.0	Mc	171401		
035	11.1	SS	015	7.6	Hk	032	9.4	Rc	004	11.7	Ht	033	10.1	Es	976	8.7	Ah
036	11.2	SS	018	7.7	Cl	033	9.6	Jo	012	11.4	Ht	034	9.8	Bj	978	8.7	Ss
036	11.6	Dh	019	7.8	Ma	033	9.3	Md	013	11.2	dK	034	10.1	Ba	984	8.6	Ah
036	12.2	Kt	019	8.0	Kp	034	9.6	Ba	020	11.0	dK	035	10.2	Hk	990	8.5	Ah
038	11.9	Kn	019	7.6	Hh	034	9.4	Rc	027	10.0	dK	035	10.1	Es	995	8.9	Ah
038	11.6	Rl	020	7.9	Kp	035	9.1	Md	040	8.6	dK	036	10.2	Hk	997	8.6	Ah
038	12.2	Rb	029	7.2	Cl	036	9.8	Md	RR SCO			036	9.9	Fc	004	9.0	Fc
039	12.0	Ma	031	7.7	Wd	036	9.8	Hk	*165030a*			036	10.1	Es	005	9.0	Ah
040	12.0	Dh	031	7.3	Ks	037	9.4	Rc	974	10.9	En	038	10.1	Es	009	9.0	Ah
040	12.3	Pt	032	7.2	Ra	038	9.7	Hf	980	11.7	Ht	038	9.8	Jo	031	9.2	Cm
043	12.3	Cm	034	7.5	Jo	038	9.3	Hk	983	11.4	En	038	10.2	Ma	031	8.8	Ks
043	11.6	Cl	038	7.6	Jo	038	9.5	Ma	985	11.6	Ht	038	9.7	Hk	032	8.9	Jo
			038	7.8	Fs	038	9.1	Md	990	11.6	Ht	038	10.2	Hf	037	9.0	Bu

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
Z OPH			S OCT			RS OPH			T DRA			VX SGR			T HER		
171401			*172486*			*174406*			175458a			*180222a*			180531		
038	9.2	Hf	990	12.0	Ht	016	11.9	Ry	042	9.5	Cl	036	9.0	Fc	031	9.8	Hm
038	8.8	Jo	004	10.4	Ht	018	10.9	SS	052	9.8	Hf	038	9.1	Md	032	10.0	Wa
040	8.7	Pt	012	9.5	Ht	019	11.8	Ry	052	10.1	Gy	038	9.1	Hf	032	9.6	Ks
042	8.5	Mb	013	10.0	dK	019	10.9	SS	UY DRA			039	9.4	Ma	032	10.0	Bc
042	9.0	Mc	020	8.8	dK	022	11.5	Ry	175458b			039	8.8	Jo	033	11.0	Jo
044	9.5	Jo	027	8.2	dK	022	10.5	SS	989	11.9	Ch	042	9.1	Hk	033	9.9	Hm
052	9.4	Hf	040	8.5	dK	026	10.4	Wa	006	12.2	Ch	043	9.1	Fc	034	9.7	Ba
056	9.0	Wd	RU OPH			026	10.4	Wp	020	12.0	Ks	043	8.9	Hk	035	11.3	Dt
RS HER			172809			027	10.5	Wp	029	11.4	Cl	044	9.3	Jo	035	10.3	SS
171723			965	12.0	Ma	031	10.3	Wp	031	11.5	Ks	045	8.9	Md	036	10.5	Hv
982	10.1	So	013	14.0	Ma	032	11.4	Jo	037	11.5	Fc	047	9.0	Jo	036	10.5	Bc
990	9.5	Fc	034	12.2	Bj	032	10.5	Wa	038	12.0	Ar	053	8.9	Md	036	10.2	SS
992	9.6	Ah	035	13.0	Fc	033	10.8	Rb	039	11.5	Kn	R PAV			038	11.3	Jo
995	9.5	Ah	036	12.1	Es	033	11.4	Hi	041	11.5	Rb	*180363*			038	10.8	Hf
997	9.5	Ah	039	11.8	Ma	034	10.3	Wp	042	12.0	Cl	977	8.4	En	038	11.1	Rb
004	9.5	Fc	040	12.0	Pt	034	10.6	Ba	RY HER			979	8.4	Ht	038	10.0	Hm
007	9.1	Ah	042	11.6	Mg	035	10.5	Bj	175519			983	7.8	En	038	10.8	Fc
009	9.0	Ah	042	11.8	Mb	037	11.3	Ry	965	9.6	Ma	984	8.0	Ht	040	11.1	Pt
013	8.4	Bj	049	11.8	Es	037	10.3	Wp	989	11.7	Ch	989	8.0	Ht	041	10.2	Hm
020	8.0	Ks	052	11.5	Gy	037	11.1	Kn	004	12.3	Fc	004	8.2	Ht	041	10.7	Hv
022	8.3	Md	RT SER			038	11.4	Hf	013	12.9	Ma	012	8.4	Ht	041	11.3	Kn
029	8.0	Md	173411			038	11.3	Jo	014	13.2	Bj	013	8.2	dK	043	11.2	Cl
029	7.9	Es	040	11.3	Mc	038	10.4	Rb	034	13.5	Md	020	8.5	dK	044	11.3	Dt
031	8.0	Hi	050	11.3	Mc	039	11.0	Ma	034	13.5	Es	027	8.7	dK	044	11.1	SS
031	8.3	Ks	RU SCO			039	10.4	Wp	035	13.4	Bj	040	9.6	dK	045	11.0	Fc
033	8.4	Jo	*173543*			040	11.0	Pt	039	13.6	Ma	T HER			045	11.0	Hv
033	8.0	Sf	977	12.6	En	042	10.7	Mg	042	13.6	Mg	180531			045	11.3	Bc
034	7.8	Bj	983	12.4	En	044	11.5	Jo	042	13.7	Mb	976	8.3	Ah	049	11.3	Dt
035	7.9	Md	020	11.0	dK	044	10.4	SS	049	13.6	Es	984	7.7	Ah	W DRA		
035	7.9	Es	040	10.6	dK	047	10.8	Rb	V DRA			985	7.7	Ah	180565		
036	7.9	Md	SV SCO			052	11.0	Wp	175654			989	7.6	Ch	989	10.5	Ch
037	7.8	Fc	*174135*			052	11.0	Wa	989	10.1	Ch	990	7.4	Ah	992	10.6	Ap
038	8.0	Hf	977	11.4	En	052	10.9	Gy	004	9.9	Fc	994	7.5	Ah	003	11.5	Hk
038	8.3	Jo	983	11.0	En	056	10.4	Wp	029	10.0	Md	995	7.8	Ah	004	11.6	Fc
038	8.1	Md	W PAV			056	10.5	Wa	033	9.9	Md	997	7.5	Ah	012	11.8	Bj
039	8.0	Es	*174162*			U ARA			038	10.0	Md	999	8.0	Fc	015	11.9	Hk
039	8.0	So	977	9.9	En	*174551*			039	10.3	Kn	002	8.0	Wh	015	11.9	Wo
040	7.7	Pt	979	10.0	Ht	979	12.7	Ht	040	10.4	Pt	004	7.9	Fc	020	11.9	Wo
041	7.8	Md	984	10.2	Ht	980	12.6	En	044	10.3	Md	005	8.0	Ah	020	12.2	Ks
042	8.3	Mb	989	10.3	Ht	984	12.8	Ht	050	10.0	Md	006	8.0	SS	030	12.7	Es
042	7.9	Mg	004	10.7	Ht	012	13.0	Ht	052	10.6	Gy	007	8.2	SS	032	12.8	Ks
042	8.2	Bb	012	10.9	Ht	RT OPH			VX SGR			007	8.1	Ah	035	13.3	Fc
043	7.8	Md	013	11.1	dK	175111			*180222a*			008	8.0	SS	035	12.8	Es
044	8.2	Jo	020	11.4	dK	989	14.8	Ap	987	9.4	Fc	009	8.1	SS	035	13.0	Bj
045	8.3	Es	027	11.4	dK	040	12.5	Pt	989	9.4	Ch	009	9.0	Dt	036	12.9	Pf
045	7.9	Ks	RS OPH			T DRA			994	9.5	Fc	009	8.4	Ah	040	12.7	Pt
045	8.3	Fc	*174406*			175458a			002	9.4	Hk	010	9.0	Dt	052	13.8	Es
047	8.4	Md	965	11.4	Ma	989	8.8	Ch	003	9.5	Fc	010	8.4	SS	X DRA		
052	8.4	Es	977	11.5	En	006	8.5	Ch	009	9.4	Hk	014	8.6	Ks	180666		
052	8.1	Jo	980	11.2	Ht	019	9.4	Cl	012	9.4	Hk	015	8.5	SS	989	11.8	Ch
052	8.6	Hf	983	11.2	En	020	9.3	Ks	015	9.4	Hk	017	8.7	SS	992	12.5	Ap
053	8.5	Md	985	11.2	Ht	029	9.1	Cl	020	9.2	Md	018	8.4	Hv	003	11.1	Hk
S OCT			989	11:5	Ch	031	8.9	Ks	026	9.0	Md	018	8.7	Bc	004	11.1	Fc
172486			990	11.3	Ht	037	9.9	Fc	030	8.8	Es	018	8.8	SS	012	11.0	Bj
974	12.1	En	004	11.6	Ht	038	9.7	Hf	033	9.5	Hi	019	8.5	Hv	016	14.1	Ks
980	12.2	Ht	012	11.3	Ht	038	10.2	Ar	034	8.9	Ba	019	8.7	Bc	020	13.6	Ks
983	12.0	En	013	11.4	Bj	039	10.0	Kn	035	8.8	Es	022	8.9	SS	035	14.2	Es
985	12.1	Ht	013	11.4	Ma	041	9.8	Rb	036	9.2	Hk	029	10.0	Hv			

Variable Star Observations Received During September, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
X Dra			**W Lyr**			**RZ Her**			**R Sct**			**R Sct**			**R Sct**		
180666			181136			183225			*184205*			*184205*			*184205*		
036	14.6	Pf	033	12.0	Jo	052	9.6	Es	967	6.0	Ra	018	5.2	Hv	035	5.7	SS
052[	14.1	Es	034	12.2	Md	**X Oph**			979	6.3	Df	018	5.1	Bc	036	5.6	SE
Nov Oph			034	12.2	Es	183308			982	6.0	Hr	019	5.5	Gb	036	5.2	Dh
180911			035	12.2	Es	595	8.4	Mi	985	5.5	Si	019	5.8	SS	036	5.5	SS
035	14.1	Ar	035	12.0	Hk	599	8.6	Mi	987	5.4	Df	019	5.7	Kp	036	5.4	Sx
036	14.1	Ar	036	11.9	Ar	665	8.7	Mi	989	5.8	Ch	019	5.3	Bc	036	5.7	Kt
037	14.1	Ar	037	11.9	Ar	920	8.4	Si	989	5.4	Hr	019	5.3	Hv	036	5.0	Hv
038	14.0	Ar	038	11.9	Ar	947	8.5	Si	989	5.8	Kv	019	5.2	Df	036	5.0	Bc
042	13.9	Ar	038	12.2	Jo	947	8.6	Hq	990	6.0	Fc	019	6.0	SE	036	5.3	Ar
043	13.8	Ar	038	12.2	Wd	985	8.8	Si	991	5.8	Bk	020	4.7	Sa	037	5.3	Ar
045	13.6	Ar	039	12.2	Es	990	8.7	Fc	992	5.4	Hr	020	5.7	Kp	037	5.3	Bk
RY Oph			039	12.4	So	999	9.0	Fc	992	5.9	SS	020	5.7	Hf	037	5.6	An
181103			040	12.3	Pt	004	8.4	Fc	992	5.9	Kv	021	5.0	Je	037	5.8	Ba
030	8.9	Es	042	12.1	Ar	011	8.4	Bj	994	5.7	SS	021	5.3	Kt	037	5.8	SS
031	9.1	Md	043	12.0	Ar	014	8.6	Ks	996	5.5	Ky	021	5.6	SS	038	5.2	Jo
032	8.7	Jo	043	12.0	Cm	019	8.8	Kp	996	5.4	Kv	021	5.5	Gb	038	5.5	Rb
035	9.0	Es	043	12.3	Wu	032	8.4	Jo	997	5.9	Kv	022	5.8	An	038	5.6	Dl
035	9.3	Lt	044	12.4	Jo	032	8.5	Ks	997	5.7	Ky	022	5.6	SS	038	4.8	Sa
036	9.0	Md	044	12.2	Rl	033	8.3	Rc	999	5.5	Kv	023	5.7	Kt	038	5.8	Sf
038	8.8	Jo	045	11.8	Ar	038	8.0	Bu	999	5.8	Pb	023	5.1	Bc	038	5.5	SE
038	9.1	Hf	049	12.5	Es	038	8.2	Jo	000	5.8	Sn	023	5.1	Ku	038	5.2	Ar
039	8.7	Kn	052	12.5	Es	039	8.5	Hf	002	5.5	SS	023	5.7	SS	038	5.5	SS
040	8.4	Jo	052	12.5	Jo	039	8.4	Wd	003	5.6	Ky	024	5.6	Rb	038	5.5	Hf
040	8.7	Pt	052	12.3	Gy	041	8.1	Rc	003	5.6	Kv	024	5.6	Pg	038	5.5	Pt
040	10.2	Mc	053	12.5	Es	041	8.0	Kn	003	5.6	Df	025	5.2	Bc	038	5.7	Sx
041	9.0	Md	055	12.5	Es	042	8.2	Bj	003	5.5	Hk	026	5.6	Ar	038	5.6	Wd
041	9.0	Lt	**RY Sct**			042	8.0	Pt	004	5.2	Sn	027	5.6	Ar	039	5.5	Rb
044	8.7	Jo	*181912*			044	8.0	Jo	005	5.3	SS	028	5.5	Bc	039	5.6	Hf
046	9.0	Lt	035	10.0	Mc	052	8.2	Jo	006	5.6	Pg	029	5.5	Bc	039	6.0	Ma
050	10.0	Mc	040	9.8	Mc	052	8.1	Hf	006	5.8	SS	029	5.0	Hv	039	5.4	Wg
051	8.8	Lt	042	10.2	Mc	064	7.5	Hb	006	5.6	Df	030	5.5	SS	039	5.5	Mc
052	8.4	Jo	050	9.9	Mc	**RY Lyr**			007	5.4	Hr	031	5.7	An	039	5.0	Wa
052	9.2	Hf	**RV Sgr**			184134			007	5.8	SS	031	5.8	Wd	040	5.2	Ku
053	9.0	Md	*182133*			982	14.0	So	008	5.8	SS	031	5.7	SS	040	5.3	Dh
055	8.9	Es	980	12.4	En	006	13.5	Ch	009	5.5	Kv	032	5.5	Rb	040	5.3	Jo
056	9.3	Rb	987	12.1	En	032	11.9	Pf	009	5.3	SS	032	5.7	Mg	040	5.6	Mc
W Lyr			**SV Her**			035	11.5	Fc	010	5.4	Kv	032	5.4	Jo	040	5.7	SS
181136			182224			039	11.0	Hf	010	5.7	SS	032	5.7	BT	040	5.0	Bu
976	8.7	Ah	004	11.8	Fc	040	10.2	Wu	011	5.2	Df	032	5.0	Bc	040	5.6	Pt
982	8.8	So	045	13.3	Fc	041	11.1	Kn	012	5.4	Hk	032	5.7	Dl	041	5.0	SC
985	9.2	Ah	**T Ser**			042	10.4	Pt	012	5.8	SS	032	5.0	Kg	041	5.6	An
990	9.4	Ah	182306			052	10.7	Hf	012	5.2	Df	032	5.8	Ra	041	5.5	Kn
990	9.2	Fc	035	12.4	Fc	**AY Lyr**			013	5.7	Bk	032	5.2	Wa	041	5.5	Hf
992	9.4	Ah	042	12.5	Pt	184137			013	5.5	SS	032	5.0	Ks	041	5.0	Bc
995	9.6	Ah	**SV Dra**			022[	14.3	Br	013	6.0	Ma	032	5.4	Ba	041	5.0	Hv
999	9.6	Fc	183149			039	13.7	Br	014	4.7	Ks	033	5.5	Rb	041	5.6	Ba
004	10.0	Fc	890	10.0	Ma	040	14.5	Br	015	5.5	SS	033	5.3	Kt	041	5.7	Rb
006	10.2	Ch	960	13.4	Ma	050	14.5	Pg	015	5.2	Wh	033	4.8	Sa	041	5.3	Ca
007	10.0	Ah	013	14.6	Ma	**R Sct**			015	5.2	Df	033	5.7	Hf	042	5.2	Dh
008	9.4	Wh	039	14.2	Ma	*184205*			016	4.8	Sa	033	5.0	Jo	042	5.2	Ar
009	10.2	Ah	**RZ Her**			913	6.3	Si	017	5.8	SS	033	5.4	Sx	042	5.5	L
015	11.1	Hk	183225			920	6.5	Si	018	6.0	SE	034	5.9	Pt	042	5.2	Hk
020	12.1	Ks	029	11.0	Es	947	5.0	Si	018	5.8	An	034	5.5	Ch	042	5.5	An
024	11.6	Es	035	10.8	Fc	947	5.0	Hq	018	5.9	SS	035	5.3	Ar	042	5.4	Mc
029	11.8	Es	041	10.3	Kn	949	5.6	Ra	018	5.1	Lf	035	5.4	Dh	042	5.4	Pt
031	12.0	Es	041	10.3	Wu	957	5.8	Ra	018	5.0	Ku	035	5.0	Bu	042	5.2	Pb
032	12.2	Ks	044	9.8	Jo	958	5.8	Ra	018	5.1	Dh	035	5.5	Mc	043	5.2	Hk
033	12.2	Md	052	9.4	Jo				018	5.4	Wg	035	5.2	Kg	043	5.3	Lf

Variable Star Observations Received During September, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
R Sct			Nov Aql			S CrA			V Lyr			TY Aql			R Sgr		
184205			184300			*185437a*			190529a			*190907*			*191019*		
043	4.8	Sa	990	10.6	Fc	004	11.7	Ht	004	[12.3	Fc	055	10.9	Es	980	10.4	Ht
043	5.0	Bc	999	10.9	Pb	012	12.1	Ht	020	10.9	Md	S Lyr			985	10.0	Ht
043	5.2	Ar	000	10.8	Pb	ST Sgr			024	10.7	Md	190925			987	10.2	En
043	4.9	Kg	001	10.8	Sn	*185512a*			031	9.7	Es	027	12.2	Wp	990	9.6	Fc
043	5.3	Pb	003	10.5	Kv	013	[12.3	Ma	031	10.1	Md	032	12.4	Wp	990	9.7	Ht
044	5.4	Mc	003	10.3	Ky	039	13.0	Ma	033	9.5	Md	032	12.2	Wa	992	9.8	SS
044	5.3	Jo	013	10.4	Ma	R CrA			033	9.7	Es	034	12.5	Wp	004	8.5	Ht
044	5.5	SS	014	11.2	Ks	*185537a*			034	9.7	Es	034	12.2	Br	004	8.5	Ch
044	5.7	SE	018	11.3	Hv	980	12.1	Ht	034	10.3	Br	037	11.9	Wp	006	8.3	SS
045	5.2	Hk	018	10.5	Dh	985	12.3	Ht	034	9.6	Md	039	12.1	Wp	007	8.3	SS
045	5.7	Kt	018	11.3	Bc	990	12.1	Ht	035	10.1	Md	042	12.0	Pt	008	8.1	SS
045	5.4	Bk	019	11.3	Bc	004	12.2	Ht	035	10.4	Fc	052	11.7	Jo	009	8.3	SS
045	4.5	Cr	019	11.3	Hv	012	11.7	Ht	036	9.8	Md	053	10.5	Md	010	8.2	SS
045	4.8	Sa	032	10.8	Ks	T CrA			038	9.6	Md	053	12.2	Wp	010	7.9	Bj
045	5.2	Hv	035	10.5	Dh	*185537b*			038	9.8	Jo	053	12.2	Wa	012	8.1	Ht
045	5.2	Bc	035	11.0	Ar	985	12.5	Ht	041	10.3	Hf	X Lyr			013	7.7	SS
045	5.1	Ar	036	10.5	Ar	990	12.5	Ht	042	9.7	Md	190926			014	7.6	Ks
045	5.8	SS	036	11.3	Hv	004	12.5	Ht	052	10.5	Jo	042	9.0	Pt	015	7.9	SS
045	5.9	SE	036	10.6	Dh	012	12.4	Ht	052	10.5	Hf	RS Lyr			017	7.7	SS
046	5.0	Sa	037	11.0	Ar	Z Lyr			RX Sgr			190933a			018	7.7	SS
046	5.2	Hk	038	11.0	Ar	185634			*190818*			982	11.4	So	019	7.8	SS
046	5.4	Mc	038	11.2	Jo	982	9.9	So	980	[12.7	Ht	034	13.9	Br	019	8.2	Hh
046	5.2	Dh	039	10.3	Ma	004	10.6	Fc	990	[12.7	Ht	042	[12.7	Pt	021	7.6	SS
046	5.8	Ba	040	10.6	Dh	042	12.0	Pt	004	[11.6	Ch	RU Lyr			022	7.3	SS
047	5.7	Rb	042	10.8	Pb	043	12.5	Wu	013	[13.1	Ma	190941			023	7.2	SS
047	5.4	Jo	042	11.0	Ar	SU Sgr			039	12.3	Ma	036	[14.0	Pf	027	7.4	Wp
048	5.7	Rb	043	11.0	Ar	*185722*			RW Sgr			040	[14.0	Br	030	7.2	SS
050	5.5	Mc	043	10.9	Pb	980	8.7	Ht	*190819a*			U Dra			032	7.5	Wp
050	5.2	Bu	045	10.8	Fc	985	8.9	Ht	980	9.4	Ht	190967			032	7.3	Wa
050	5.6	Pt	045	11.0	Ar	990	8.7	Ht	985	9.5	Ht	990	13.3	Fc	033	7.0	Jo
050	5.2	Dl	045	11.3	Bc	004	8.6	Ht	987	9.9	En	003	[12.0	Hk	034	7.0	Bj
051	5.4	Mc	045	11.3	Hv	012	8.7	Ht	990	9.5	Ht	016	14.3	Ks	034	7.0	Wp
051	5.7	Pg	050	11.6	Pt	RT Lyr			004	9.5	Ht	035	13.7	Es	035	7.2	SS
051	5.5	Pt	052	11.4	Jo	185737			004	9.7	Ch	036	14.2	Pf	036	7.1	Ar
052	5.2	Hf	RX Lyr			982	10.3	So	012	9.8	Ht	040	14.3	Br	036	7.1	Hk
052	5.0	Jo	185032			004	10.4	Fc	013	9.8	Ma	052	[13.5	Es	036	7.1	SS
052	5.1	Hs	982	12.7	So	032	11.8	Pf	038	10.2	Hf	W Aql			037	7.0	SS
052	5.7	Pg	018	14.2	Dh	036	12.0	Pf	039	10.2	Ma	*191007*			037	7.0	Bu
052	5.6	Gy	026	14.5	Ar	045	12.3	Cl	042	10.5	Pt	013	13.4	Bj	037	7.3	Wp
053	5.2	Hf	027	14.5	Ar	V Aql			TY Aql			019	12.8	Ma	038	7.0	Jo
053	5.0	Kg	028	14.6	Ar	*185905*			*190907*			029	13.3	Es	038	7.5	Hf
053	5.0	Dl	035	14.8	Ar	014	6.7	Ks	013	10.8	Bj	035	13.5	Ar	038	7.4	Hh
055	6.0	Sh	035	14.7	Dh	R Aql			019	10.1	Ma	036	13.6	Ar	039	7.2	Wp
055	5.7	Ba	036	14.8	Ar	190108			020	10.6	Md	037	13.7	Ar	039	7.1	Wa
056	5.3	Cm	036	14.8	Pf	984	11.3	Ah	029	10.6	Es	038	13.6	Ar	040	7.1	Jo
056	5.3	Wd	037	14.8	Ar	990	11.2	Fc	035	10.6	Md	039	13.5	Ma	040	7.0	SS
056	5.3	Pt	038	14.9	Ar	014	11.5	Ks	035	10.5	Ar	040	13.4	Es	042	7.0	Pt
058	4.8	Kg	042	14.5	Ar	038	11.7	Jo	036	10.6	Ar	042	13.3	Bj	044	7.5	Ca
059	5.3	Pt	043	14.6	Ar	041	11.7	Hf	037	10.5	Ar	042	13.6	Ar	044	7.1	Jo
059	5.2	Wh	045	14.8	Ar	042	11.6	Pb	038	10.8	Ar	043	13.7	Ar	044	7.0	SS
062	5.4	Hb	S CrA			042	11.6	Hk	039	10.2	Ma	043	13.8	Br	045	7.4	Je
RW Lyr			*185437a*			042	11.6	Pt	040	10.6	Es	045	13.8	Ar	045	7.1	SS
184243			977	12.0	En	043	11.7	Pb	041	10.5	Hf	T Sgr			046	7.7	Ke
004	[12.1	Hk	980	11.6	Ht	045	11.5	Cl	042	10.5	Pt	*191017*			052	6.5	Wp
Nov Aql			983	12.2	En	052	11.6	Jo	042	10.5	Ar	004	10.0	Ch	052	6.3	Wa
184300			985	12.1	Ht	V Lyr			042	10.8	Bj	014	10.2	Ks	056	7.5	Wa
985	10.8	Si	987	12.1	En	190529a			043	10.5	Ar	042	11.5	Pt	056	7.6	Wp
989	10.7	Kv	990	12.1	Ht	982	[14.1	So	045	10.5	Ar	044	11.7	Fc	062	7.8	Hb

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

RY SGR

191033

J.D.	Est.	Obs.
955	7.1	Si
973	7.0	En
975	7.0	Si
977	6.9	En
978	7.1	Ch
980	6.9	Ht
980	7.0	En
983	7.0	En
985	6.9	Ht
985	6.6	Si
987	6.9	En
989	7.0	En
989	7.2	Hr
990	7.2	Fc
990	6.9	Ht
991	7.0	Bl
992	7.3	Hr
004	7.5	Ht
004	7.5	Ch
007	7.8	Hr
010	7.7	Bj
012	7.7	Ht
013	7.4	dK
014	7.4	Ks
020	6.7	Kn
020	7.1	dK
027	7.0	dK
033	6.7	Jo
034	6.6	Ba
034	6.8	Bj
034	6.5	Pt
038	6.9	Jo
038	6.5	Pt
040	7.2	dK
040	6.6	Pt
040	7.0	Jo
042	6.6	Pt
042	7.2	An
042	7.2	L
042	6.8	Bj
044	7.0	Jo
047	7.2	Jo
050	7.4	Rb
050	6.7	Pt
056	6.4	Pt
059	6.3	Pt

TY SGR

191124

J.D.	Est.	Obs.
987	10.5	En
011	10.3	Bj
034	11.2	Bj

S SGR

191319a

J.D.	Est.	Obs.
980	11.9	Ht
985	11.8	Ht
987	11.5	En
990	11.2	Ht
004	10.6	Ht

S SGR

191319a

J.D.	Est.	Obs.
004	10.9	Ch
010	10.5	Bj
012	10.6	Ht
034	11.1	Bj
036	11.3	Hk
038	10.9	Hf
042	11.6	Pt
046	[11.1	Ke

Z SGR

191321

J.D.	Est.	Obs.
011	9.2	Bj
034	10.9	Bj
036	11.8	Hk

SW SGR

191331

J.D.	Est.	Obs.
987	12.1	En

TZ CYG

191350

J.D.	Est.	Obs.
006	11.0	Ch
026	11.1	Ar
034	10.7	Ba
035	10.8	Ar
036	11.0	Ar
037	10.7	Ar
038	10.9	Ar
041	11.0	Hf
042	10.7	Pt
042	11.0	Ar
043	11.1	Ar
045	11.0	Ar
048	10.7	Jo
052	10.8	Jo

U LYR

191637

J.D.	Est.	Obs.
018	11.0	Dh
035	11.0	Dh
035	10.9	Ku
038	11.1	Rb
042	10.6	Pt
044	11.8	Jo
052	12.0	Jo
052	11.2	Hf
052	11.1	Gy

UZ LYR

191737

J.D.	Est.	Obs.
018	11.0	Dh

AF CYG

192745

J.D.	Est.	Obs.
012	7.3	Ra
032	7.5	Ra

TY CYG

192928

J.D.	Est.	Obs.
989	13.6	Ch
036	[14.3	Pf
040	[14.0	Br
042	12.7	Pt

RT AQL

193311

J.D.	Est.	Obs.
989	13.3	Ch
011	13.3	Ks
014	13.5	Ks
019	13.4	Ma
035	14.0	Br
039	13.5	Ma
040	14.4	Br
042	13.6	Pt

R CYG

193449

J.D.	Est.	Obs.
949	8.8	ST
949	8.7	Si
984	9.9	Ah
989	9.6	Ch
990	10.1	Ah
006	10.8	Ch
018	10.1	Hv
018	10.2	Bc
019	10.5	Bc
019	10.5	Hv
019	11.0	Ma
020	10.9	Sq
021	11.2	Kt
023	11.2	Kt
029	10.3	Es
033	11.8	Kt
035	11.1	Es
035	11.7	Kt
035	11.2	Mc
038	11.0	Dl
038	12.0	Jo
038	11.2	Ma
039	11.4	Mc
039	11.7	Hf
043	11.9	Kn
043	12.1	Wd
043	12.1	Cm
044	12.3	Rl
045	12.0	Cl
045	11.4	Es
050	12.1	Pt
052	11.6	Es

RV AQL

193509

J.D.	Est.	Obs.
035	11.2	Ar
035	11.3	Br
036	11.2	Ar
037	11.3	Ar
038	11.4	Ar
042	12.0	Ar
043	12.0	Ar
045	12.0	Ar
050	12.1	Pt

T PAV

193972

J.D.	Est.	Obs.
980	9.5	Ht
985	10.1	Ht
990	10.3	Ht

T PAV

193972

J.D.	Est.	Obs.
004	11.3	Ht
012	12.0	Ht
013	11.7	dK
020	11.9	dK
027	[11.9	dK

RT CYG

194048

J.D.	Est.	Obs.
984	11.7	Ah
989	10.9	Ch
990	11.1	Ah
003	10.0	Kg
006	9.8	Ch
009	9.5	Ah
018	10.8	Dh
019	9.2	Ma
033	8.4	Sx
033	8.3	Hm
035	8.2	Mc
035	8.0	Es
035	9.7	Dh
036	9.6	Dh
038	9.6	Dh
038	7.5	Jo
038	8.1	Ma
038	8.4	Hm
039	8.0	Mc
039	7.9	Hf
040	9.5	Dh
041	8.2	Hm
042	9.6	Dh
042	8.0	Mc
043	8.0	Wd
043	8.2	Cm
043	9.7	Dh
043	7.7	Kn
044	7.8	Hm
045	7.3	Cl
046	9.7	Dh
050	7.8	Mc
050	7.1	Pt
052	7.5	Gy
052	8.0	Hf
052	7.8	Jo

TU CYG

194348

J.D.	Est.	Obs.
989	[12.8	Ch
006	12.6	Ch
018	12.0	Ry
021	11.5	Ry
035	10.7	Ry
035	10.8	Es
038	9.8	Jo
038	11.1	Ma
039	10.8	Hf
040	11.1	Ma
042	10.1	Br
043	10.1	Kn
043	9.8	Wd

TU CYG

194348

J.D.	Est.	Obs.
043	10.0	Cm
044	10.1	Ry
050	9.6	Pt
052	10.0	Gy
052	10.2	Hf
052	10.0	Jo

X AQL

194604

J.D.	Est.	Obs.
013	9.9	Mw
018	10.1	Bc
018	10.1	Hv
019	9.9	Hv
019	9.9	Bc
029	10.5	Hv
032	10.5	Bc
033	10.6	Sf
035	10.9	Hi
035	10.8	Mc
035	10.9	Br
036	10.7	Hv
036	10.7	Bc
039	11.0	Hf
042	11.1	Mc
042	11.1	Hk
044	11.3	Fc
045	11.3	Bc
046	11.3	Hv
050	11.8	Pt
052	11.7	Hf

X CYG

194632

J.D.	Est.	Obs.
989	10.7	Ch
006	11.1	Ch
013	11.4	Bj
013	11.5	Mw
019	11.5	Wo
032	13.0	Td
033	13.1	Td
034	12.3	Br
035	13.1	Td
035	12.2	Es
036	12.8	Bj
039	13.0	Td
040	12.1	Ma
041	13.0	Td
043	12.5	Td
043	12.8	Wd
043	12.6	Cm
050	12.9	Pt
052	12.7	Td

S PAV

194659

J.D.	Est.	Obs.
013	7.9	dK
020	7.9	dK
027	7.9	dK
040	7.8	dK

RU SGR

195142

J.D.	Est.	Obs.
977	7.2	En
980	7.2	Ht
985	7.2	Ht
987	7.2	En
990	7.2	Ht
004	8.0	Ht
012	8.2	Ht
013	8.2	dK
020	8.8	dK
027	9.2	dK
040	10.5	dK

RR AQL

195202

J.D.	Est.	Obs.
012	11.4	Bj
032	12.6	Bj
034	12.4	Br
042	11.5	Hk

RS AQL

195308

J.D.	Est.	Obs.
012	[13.1	Bj
032	[13.8	Bj

Nov CYG

195553

J.D.	Est.	Obs.
006	[13.2	Ch
026	13.8	Ar
027	13.8	Ar
028	13.8	Ar
029	13.8	Ar
035	13.8	Ar
036	13.8	Ar
037	13.3	Ar
038	14.0	Ar
042	14.3	Ar
043	14.3	Ar
045	14.3	Ar

RR TEL

195656

J.D.	Est.	Obs.
980	[12.8	Ht
990	[12.6	Ht
012	[12.8	Ht

Z CYG

195849

J.D.	Est.	Obs.
004	11.0	Fc
006	11.2	Ch
042	12.8	Br
044	12.7	Fc
050	12.6	Pt

S TEL

195855

J.D.	Est.	Obs.
980	12.8	Ht
985	12.9	Ht
990	12.9	Ht
004	12.8	Ht
012	12.8	Ht

SY AQL

200212

J.D.	Est.	Obs.
020	11.6	Md

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
SY AQL			Z AQL			RS CYG			WX CYG			U CYG			Z DEL		
200212			*200906*			200938			201437b			201647			202817		
031	9.7	Es	039	11.0	Jo	045	7.4	Ke	035	12.0	Ar	023	10.3	SS	040	9.8	Ma
035	9.7	Fc	042	11.4	Hk	045	7.2	Je	035	11.9	Jo	024	9.5	Je	043	10.2	Cy
038	9.7	Es	042	11.4	Pb	045	7.3	Bc	036	11.9	Es	024	8.7	Es	043	10.2	So
041	9.3	Br	043	11.5	Pb	045	7.3	Ar	036	11.8	Bj	028	8.3	Es	044	10.0	Fc
049	9.7	Es	050	10.5	Pt	046	7.3	Ke	036	12.0	Ar	031	10.0	Md	050	10.2	Pt
050	9.8	Pt	R SGE			049	6.9	Wh	036	11.9	Es	032	9.8	Dl	ST CYG		
S CYG			200916			050	7.0	Pt	037	12.2	Ar	032	9.6	Ra	202954		
200357			048	9.2	Jo	052	7.2	Je	038	11.8	Ar	033	8.6	Es	985	[13.5	Ht
989	11.4	Ch	052	9.2	Jo	052	7.7	Hf	042	11.8	Ar	035	9.9	Md	006	[13.7	Ch
006	11.4	Ch	RS CYG			052	7.4	Gy	043	12.1	Md	035	8.6	Es	020	13.9	Br
032	12.5	Pf	200938			054	7.4	By	043	12.1	Wd	035	9.8	Ke	035	13.1	Es
039	13.0	Es	913	7.6	Si	064	7.0	Hb	043	11.4	Cm	035	9.8	Mc	041	13.7	Br
041	13.3	Br	918	7.9	Si	R DEL			045	12.0	Kg	035	8.6	SS	049	12.7	Es
050	12.1	Pt	947	7.6	Si	201008			045	11.8	Ar	036	9.8	Md	050	13.4	Pt
R CAP			947	8.2	Hq	999	11.3	Bj	045	11.9	Md	036	8.7	Es	V VUL		
200514			948	7.8	Si	020	10.4	Br	048	11.7	Md	036	8.5	Bj	203226		
032	11.7	Wp	948	7.8	ST	036	9.2	Bj	049	11.6	Es	036	10.0	SS	050	8.8	Pt
032	11.9	Wa	975	7.3	Si	038	9.3	Jo	052	12.0	Jo	037	8.4	Wh	RU VUL		
037	12.0	Wp	985	7.1	Si	039	9.3	Hf	052	11.6	Md	038	8.0	Fs	203422a		
050	11.9	Pt	990	7.4	Ch	040	9.0	Bu	052	12.1	Gy	038	8.7	Jo	985	9.3	Ah
S AQL			994	7.0	Fc	042	9.5	Mc	053	11.6	Es	038	10.0	Ke	987	9.3	Fc
200715a			006	7.2	Ch	050	8.9	Pt	055	11.3	Es	038	9.9	Hf	990	9.2	Ch
994	9.7	Fc	008	7.2	Wh	051	8.3	Lt	V SGE			038	9.5	Hh	993	9.4	Ah
005	9.7	Ch	018	7.2	Hv	051	8.5	Bu	201520			038	9.5	Hm	995	9.3	Ah
011	9.5	Ks	018	7.2	Bc	052	8.6	Hf	990	11.2	Fc	039	9.5	Mc	003	9.5	Fc
027	9.4	Wp	019	7.2	Bc	052	8.5	Jo	020	11.7	Br	039	9.6	Md	006	9.2	Ch
031	9.6	Wp	019	7.3	Hv	054	8.9	Lt	026	12.0	Wp	040	9.9	Se	010	10.0	Ap
031	9.6	Wa	020	7.5	Sq	SX CYG			026	11.9	Wa	041	9.9	Rb	014	10.0	Bj
037	9.6	Wp	021	7.2	Je	201130			034	11.5	Wp	042	9.6	Md	019	10.5	Ma
039	9.6	Wp	024	7.2	Je	005	11.5	Ch	035	11.2	Ar	043	9.8	Kn	029	10.8	Es
039	9.5	Hf	028	7.6	Ar	020	10.2	Br	036	10.9	Ar	043	9.8	Wd	030	10.5	Es
042	9.6	Hk	029	7.6	Ar	024	10.1	Es	037	10.8	Ar	043	9.9	Cm	031	10.7	Es
044	10.0	Fc	029	7.3	Hv	035	9.9	Es	037	11.1	Wp	044	9.5	Fc	033	10.3	Kt
048	9.8	Jo	031	7.3	Hm	039	10.2	Hf	038	10.8	Ar	044	9.6	Md	033	10.5	Es
050	9.5	Pt	032	7.3	Bc	050	9.9	Pt	039	10.7	Hf	044	8.8	SS	034	10.8	Es
052	9.7	Hf	032	7.5	Ra	052	10.0	Gy	039	10.8	Wp	044	9.3	Es	034	10.4	Ba
052	10.0	Wp	032	7.7	Cm	052	10.1	Jo	041	10.9	Hf	045	8.2	Sa	035	10.6	Es
052	9.8	Wa	033	7.3	Hm	052	9.7	Es	042	10.8	Ar	045	9.5	Je	036	10.5	Kt
052	9.7	Jo	033	7.5	Kg	053	9.9	Hf	045	11.2	Ar	045	9.8	Ke	036	11.0	Fc
RW AQL			034	7.2	Ch	WX CYG			046	11.3	Br	045	8.9	SS	038	11.3	Ma
200715b			034	7.3	Jo	201437b			052	11.6	Gy	045	8.7	Kg	039	10.9	Es
044	8.6	Fc	035	7.6	Ar	982	12.9	So	053	11.9	Wp	046	9.6	Ke	039	10.5	Hf
048	9.0	Jo	036	7.3	Hv	006	12.6	Ch	053	11.7	Wa	049	9.3	Es	041	10.8	Rb
050	9.2	Pt	036	7.2	Bj	013	12.2	Bj	U CYG			050	9.3	Es	041	10.6	Ac
052	9.2	Jo	036	7.5	Ar	026	12.8	Ar	201647			050	9.0	Md	043	10.8	Kt
RU AQL			036	7.3	Bc	027	11.6	Es	982	11.0	So	050	9.5	Mc	043	11.1	Cm
200812			037	7.5	Ar	028	12.6	Ar	990	10.0	Ch	050	8.5	Pt	043	11.0	Fc
041	[13.8	Br	038	7.2	Jo	029	12.6	Ar	994	9.9	Fc	052	9.4	Gy	045	10.5	Bj
W CAP			038	7.7	Hf	029	12.0	Md	003	10.0	Hk	052	8.7	Jo	045	10.4	Kt
200822			038	7.4	Hm	030	11.2	Es	004	10.7	Ku	052	9.7	Hf	050	10.9	Es
035	11.7	Fc	041	7.2	Hm	031	12.0	Md	008	8.4	Wh	053	9.4	Dl	053	10.7	Es
040	11.5	Fc	041	7.3	Hv	031	11.9	Es	008	10.0	SS	053	9.0	Md	053	10.7	Wp
050	10.4	Pt	041	7.3	Bc	032	12.2	Ra	010	10.5	SS	055	9.3	Es	053	10.7	Wa
Z AQL			042	7.6	Ar	032	11.9	Cm	013	9.8	Bj	Z DEL			055	10.7	Es
200906			043	7.5	Ar	033	12.0	Kg	019	9.9	Hh	202817			Y DEL		
999	12.9	Bj	043	7.8	Wd	033	11.9	Es	019	10.9	So	020	9.0	Br	203611		
032	12.6	Bj	043	7.6	Cm	035	12.0	Md	020	9.0	Sq	035	9.7	Es	020	[14.2	Br
035	12.6	Hi	045	7.3	Hv				021	10.0	Je	035	9.9	Hi	040	[13.9	Ma

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
S DEL			V AQR			T AQR			R VUL			T CEP			RR AQR		
203816			204102			*204405*			205923			210868			*210903*		
020	11.4	Md	050	8.4	Pt	044	9.1	Hm	005	9.9	Ah	949	5.7	ST	040	9.7	Jo
035	11.0	Md	052	9.0	Jo	045	8.0	Hv	007	10.0	Ah	975	7.5	By	042	9.7	Bj
039	10.6	Hf	053	9.1	Es	045	8.3	Bc	009	10.3	Ah	975	7.4	Si	050	9.9	Pt
047	10.9	Md	053	9.3	Wp	045	8.5	SS	014	11.0	Bj	984	7.5	Ah	RU PEG		
050	11.4	Pt	053	9.0	Wa	050	8.7	Dl	020	11.8	Md	985	7.5	Ah	210912		
V CYG			055	8.9	Es	050	8.5	Pt	022	11.9	Br	985	7.0	Si	050	13.1	Pg
203847			W AQR			052	8.8	Hs	034	12.7	Es	990	7.6	Ah	Y PAV		
990	10.5	Ch	*204104*			052	8.9	Jo	044	13.0	Bj	990	7.8	Ch	211570		
994	10.3	Fc	034	9.4	Jo	053	9.0	Dl	046	13.6	Br	991	7.9	Bk	980	6.0	Ht
011	11.2	Ma	035	10.0	Hi	056	9.1	Kg	049	12.9	Es	992	7.7	Ah	985	6.2	Ht
015	10.7	Hk	037	10.0	Kn	064	9.0	Hb	050	12.6	Pt	994	7.7	Ah	990	6.2	Ht
021	11.1	Br	039	10.3	Hf	RZ CYG			V CAP			995	7.7	Ah	004	6.0	Ht
024	10.0	Je	039	9.6	Jo	204846			*210124*			997	7.9	Ah	012	6.0	Ht
040	11.8	Ma	043	10.3	Hk	022	13.5	Br	955	9.5	Si	004	8.5	Ch	X PEG		
043	11.3	Kn	044	10.0	Jo	027	13.2	Wp	985	10.3	Si	005	8.1	Ah	211614		
044	11.8	Fc	052	10.1	Jo	031	13.2	Wp	015	11.2	Bj	007	8.1	Ah	011	10.8	Ma
045	10.0	Je	V DEL			031	13.3	Wa	042	13.0	Bj	009	8.1	Ah	022	11.2	Br
045	11.0	Kg	204318			032	13.3	Wa	TW CYG			018	9.0	Ch	040	12.2	Ma
050	11.5	Pt	011	[13.1	Ma	032	13.3	Wp	210129			019	8.7	Kp	046	12.5	Br
053	11.0	Hf	041	[14.4	Br	034	13.3	Wp	022	13.8	Br	019	9.0	Hh	050	13.0	Pt
Y AQR			T AQR			037	13.3	Wp	042	14.2	Br	020	8.5	Cl	T CAP		
203905			*204405*			039	13.3	Wp	X CAP			020	8.9	Kp	*211615*		
011	[13.3	Bj	985	9.3	Si	042	13.6	Br	*210221*			022	8.5	Sq	045	13.0	Bj
043	[12.3	Hk	991	9.1	Bk	050	13.2	Pt	015	13.3	Bj	024	8.8	Je	S MIC		
050	[13.3	Pt	005	8.0	Ch	052	13.1	Wp	035	11.9	Fc	031	9.0	Hm	*212030*		
T DEL			010	8.3	SS	052	13.2	Wa	040	11.4	Bj	032	9.0	Hm	042	13.9	Bj
204016			011	7.2	Bj	056	13.1	Wa	050	11.6	Pt	032	8.8	Rb	Y CAP		
996	12.1	Hk	018	7.5	Hv	056	13.2	Wp	X CEP			032	9.0	Ra	*212814*		
021	10.0	Br	018	7.5	Bc	S IND			210382			032	9.0	Ch	045	[13.2	Bj
039	9.7	Hf	018	8.1	SS	204954			034	[11.1	Ch	033	9.2	Ch	W CYG		
042	9.5	Hk	019	7.5	Hv	012	[13.5	Ht	042	[14.6	Br	033	8.6	Jo	213244		
043	9.7	Cy	019	7.5	Bc	X DEL			RS AQR			033	9.3	Dl	022	6.6	An
043	9.7	So	022	8.2	SS	205017			*210504*			033	8.9	Hm	035	6.0	Mc
050	9.5	Pt	029	7.9	Hv	996	10.4	Hk	011	10.6	Bj	034	8.6	Ba	039	5.9	Mc
053	9.7	Hf	031	8.9	Hm	020	9.5	Md	037	10.2	Kn	038	8.8	Jo	040	6.0	Mc
V AQR			032	8.9	Hm	022	9.7	Br	042	10.6	Bj	038	9.4	Hh	041	6.1	An
204102			032	7.8	Bc	029	9.8	Md	050	10.9	Pt	038	9.3	Hm	042	6.1	Mc
023	9.2	Lt	032	7.8	Jo	034	9.5	Md	Z CAP			039	10.1	Mc	044	6.1	Mc
027	9.0	Wp	033	8.8	Dl	034	9.5	Es	*210516*			041	8.7	Jo	046	6.0	Mc
029	8.9	Es	033	8.8	Hm	039	9.6	Hf	040	10.2	Jo	041	9.1	Hf	050	5.9	Mc
031	9.1	Wp	035	8.2	Cm	042	9.7	Hk	042	9.8	Bj	041	9.2	Hm	051	6.0	Mc
031	9.2	Wa	036	8.0	Hv	043	9.4	Md	047	10.2	Jo	042	9.2	Cl	S CEP		
032	9.1	Wa	036	8.0	Bc	049	9.4	Md	050	10.2	Pt	042	9.9	Mc	213678		
032	9.1	Wp	036	8.3	SS	050	9.8	Pt	R EQU			043	8.9	Kn	022	9.5	Sq
033	9.6	Md	037	8.0	Bu	053	9.8	Hf	210812			043	9.2	Wd	032	9.4	Ra
035	9.0	Hi	038	8.8	Dl	UX CYG			011	12.4	Ma	044	9.2	Hm	033	10.2	Rc
037	9.3	Kn	038	8.7	Hm	205030a			022	13.6	Br	045	9.5	Je	033	9.6	Jo
037	9.0	Wp	039	8.6	Hf	022	11.9	Br	035	13.1	Es	045	9.4	Ke	034	10.2	Ch
038	9.3	Md	040	7.8	Jo	046	12.9	Br	040	13.1	Ma	050	9.8	Mc	034	9.5	Ba
039	8.9	Jo	041	8.1	Hv	R VUL			044	12.3	Bj	050	9.5	Dl	035	10.0	Md
039	9.5	Hf	041	8.9	Bc	205923			050	11.4	Es	050	8.7	Pt	035	10.4	Hi
039	9.1	Wp	041	8.0	Cm	976	8.2	Ah	050	11.8	Pt	052	9.4	Gy	038	9.4	Jo
040	9.2	Es	041	9.0	Hm	984	8.2	Ah	052	10.9	Jo	053	9.5	Hf	039	9.6	Mc
042	9.2	Md	042	8.0	Bj	985	8.4	Ah	T CEP			056	9.8	Rb	041	9.5	Jo
043	9.1	Hk	043	8.9	Bc	992	8.7	Ah	210868			056	9.4	Wd	041	10.0	Hf
044	9.1	Jo	043	8.3	Hk	994	9.0	Ah	918	5.7	Si	061	9.7	Ba	043	9.8	Kn
047	9.3	Md	044	8.0	Jo	995	9.1	Ah	947	6.4	Si	064	9.8	Hb	045	9.9	Md
049	9.2	Es	044	8.5	SS	997	9.1	Ah	949	5.8	Si				052	10.0	Gy

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
S CEP			V PEG			RY LAC			S LAC			TV AND			VY AND		
213678			215605			220843b			222439			225342			225745		
052	8.6	Pt	052[	12.7	Pt	019	11.5	Ma	045	8.7	Kn	034	10.0	Jo	053	10.5	Es
053	9.9	Hf	U AQR			026	11.5	Wp	047	8.5	Md	035	10.8	Hk	053	10.7	Hf
056	9.5	Wd	*215717*			026	11.5	Wa	047	8.7	Lt	036	10.6	Hk	053	10.6	Wp
056	9.7	Cm	045	12.2	Bj	033	11.6	Md	048	8.5	Jo	036	10.4	Fc	053	10.6	Wa
RU CYG			052	12.0	Pt	035	11.5	Md	052	8.6	Es	036	10.3	Bj	055	10.5	Es
213753			RT PEG			035	11.5	Hk	052	8.7	Pt	038	10.4	Ba	RW PEG		
016	10.0	Ry	215934			036	11.6	Hk	052	9.1	Lt	038	10.4	Ma	225914		
018	9.7	Hv	934	11.0	Ma	036	11.8	Fc	053	8.7	Md	038	10.4	Hk	040	14.2	Ma
018	9.7	Bc	035[	13.8	Br	038	11.2	Hk	053	8.7	Hf	041	10.4	Jo	045[	13.2	Bj
019	9.8	Bc	043	11.3	Cm	038	11.3	Ma	R IND			041	10.3	Hf	052[	13.2	Pt
019	9.6	Hv	RY PEG			039	11.6	Wa	*222867*			042	10.3	Hk	R PEG		
022	10.1	Ry	220133a			041	11.3	Hf	980	10.5	Ht	043	10.4	Hk	230110		
029	9.7	Hv	055	12.3	Es	042	11.2	Hk	990	11.0	Ht	043	10.4	Fc	034	10.5	Jo
032	9.7	Bc	RZ PEG			043	10.8	Hk	004	11.8	Ht	045	10.3	Hk	036	11.0	Kt
033	9.8	Jo	220133b			043	11.3	Fc	012	12.7	Ht	046	10.4	Mc	039	10.5	Jo
035	10.0	Mc	052	12.7	Es	045	11.1	Hk	T TUC			052	9.1	Es	039	10.2	Hf
036	9.8	Hv	055	12.2	Es	047	11.5	Md	*223462*			053	9.1	Hf	039	10.0	Wd
036	9.8	Bc	T PEG			053	11.3	Md	980	10.6	Ht	054	9.3	Cm	041	9.2	Hm
038	10.0	Jo	220412			056	11.0	Wp	985	10.7	Ht	055	9.0	Es	041	10.2	Jo
039	9.9	Mc	035	12.9	Hi	056	11.0	Wa	990	11.0	Ht	056	8.6	Cm	043	9.7	Sf
041	9.9	Hf	045	13.0	Bj	RU PEG			004	11.8	Ht	056	9.0	Wa	043	10.3	Cm
041	9.7	Jo	052	12.6	Es	220912			012	12.5	Ht	SZ AND			044	9.2	Hm
043	10.0	Kn	Y PEG			025	12.7	Br	R LAC			225542			045	10.0	Ke
044	10.0	Ry	220613			035	12.7	Br	223841			994[	11.7	Fc	045	9.5	Bj
045	9.8	Hv	045[	13.7	Bj	039	12.5	Br	034	9.7	Jo	002[	11.7	Hk	046	9.9	Ke
045	9.8	Bc	RS PEG			041	12.0	Br	035	9.3	Mc	015[	12.5	Bj	047	9.6	Jo
047	9.7	Jo	220714			042	11.9	Br	039	9.7	Hf	018	14.3	Dh	050	9.4	Dl
051	9.7	Mc	045[	13.7	Bj	046	11.5	Br	039	9.7	Wd	026[	13.0	Wa	052	8.9	Hs
052	9.7	Hf	RS LAC			X AQR			039	9.8	Br	036[	13.0	Bj	052	9.0	Pt
052	9.2	Pt	220843a			*221321*			041	9.7	Jo	038[	13.0	Ma	053	9.1	Hf
RV CYG			002	11.3	Hk	019	8.9	Lt	041	9.7	Lt	039[	13.0	Br	053	9.3	Dl
213937			012	11.2	Hk	042	9.4	Bj	043	9.8	Hk	042[	12.5	Hk	056	8.6	Kg
990	7.3	Fc	018	11.3	Dh	S GRU			045	9.9	Kn	046[	11.3	Mc	V CAS		
993	8.2	Ka	019	11.0	Ma	*221948*			048	9.9	Jo	056[	13.5	Wa	230759		
994	8.4	Ka	026	11.1	Wp	990[	12.8	Ht	S AQR			VY AND			015	10.0	Hk
994	7.4	Fc	026	11.3	Wa	012[	12.8	Ht	*225120*			225745			019	10.4	Wg
995	8.3	Ka	033	10.8	Md	RV PEG			039	11.0	Jo	987	10.2	Fc	034	8.9	Jo
009	8.2	Ka	035	10.9	Md	222129			042	9.9	Bj	994	10.2	Fc	036	9.2	Ar
012	8.3	Ka	035	11.0	Hk	003	11.3	Fc	TV AND			996	10.5	Hk	037	9.2	Ar
052	6.4	Pt	036	10.9	Hk	039	12.5	Br	225342			002	10.5	Hk	038	9.2	Ar
RR PEG			036	10.6	Fc	S LAC			985	9.4	Ah	004	10.5	Hk	039	8.8	Jo
214024			038	10.9	Ma	222439			987	10.0	Fc	012	10.6	Hk	039	9.4	Hf
934	11.6	Ma	038	11.0	Hk	003	8.9	Fc	993	9.7	Ah	018	10.8	Dh	039	9.2	Wg
035	14.3	Es	039	11.2	Wa	018	8.1	Lt	994	10.0	Fc	019	10.8	Ma	041	8.6	Jo
042	14.3	Br	041	11.0	Hf	023	8.1	Lt	995	10.2	Ah	019	10.5	Kp	042	9.1	Ar
050	14.3	Es	042	10.9	Hk	023	8.6	Md	996	10.3	Hk	020	10.7	Kp	042	8.9	Cl
R GRU			043	11.1	Hk	030	8.2	Lt	000	10.4	Ku	034	10.6	Jo	043	9.0	Ar
214247			043	10.7	Fc	031	8.7	Md	002	10.4	Hk	035	10.5	Hk	045	8.9	Ar
990	11.7	Ht	045	10.9	Hk	034	8.0	Jo	003	10.4	Fc	036	10.5	Hk	047	8.7	Jo
004	9.7	Ht	047	10.7	Md	035	8.4	Md	004	10.4	Hk	036	10.8	Fc	050	8.9	Pg
012	8.7	Ht	053	10.4	Md	035	8.1	Lt	012	10.6	Hk	038	10.7	Hk	052	8.9	Gy
013	8.7	dK	056	10.5	Wp	039	8.3	Md	015	10.5	Bj	038	10.5	Ma	052	8.4	Pt
020	8.6	dK	056	10.5	Wa	039	8.1	Hf	015	10.7	Hk	038	10.2	Ba	053	9.2	Hf
027	8.6	dK	RY LAC			039	8.0	Wd	018	10.5	Dh	041	10.7	Hf	056	8.6	Wd
040	8.7	dK	220843b			041	8.3	Jo	019	10.5	Ma	042	10.5	Hk	TY AND		
V PEG			002	11.4	Hk	041	8.4	Lt	026	10.7	Wp	043	10.7	Hk	231040		
215605			012	11.8	Hk	041	8.5	Md	026	10.7	Wa	043	10.5	Fc	985	9.9	Ah
039[	13.8	Br	018	11.5	Dh	042	8.6	Hk	033	10.9	Rb	045	10.7	Hk	993	9.9	Ah

Variable Star Observations Received During September, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
TY And			**W Peg**			**Z And**			**R Aqr**			**Z Cas**			**R Cas**		
231040			231425			232848			*233815*			233956			235350		
994	9.9	Fc	990	10.7	Fc	934	10.7	Ma	985	10.3	Si	033	11.2	Br	050	9.8	Dl
995	9.7	Ah	034	11.5	Jo	999	10.7	Pb	020	9.7	Kn	038	11.6	Jo	053	9.1	Hf
996	10.0	Hk	039	11.7	Jo	000	10.6	Pb	032	8.8	Wp	041	12.0	Jo	056	9.8	Wd
000	9.8	Ku	041	12.1	Hf	026	10.7	Ar	032	9.0	Wa	041	11.3	Hf	056	9.4	Cm
002	9.9	Hk	045	12.1	Bj	027	10.7	Ar	034	9.2	Jo	043	11.3	Cy	**Z Peg**		
004	9.8	Hk	047	11.8	Jo	028	10.7	Ar	037	9.2	Wp	043	11.3	So	235525		
012	9.8	Hk	**S Peg**			029	10.7	Ar	038	8.4	Hm	**RR Cas**			003	11.3	Fc
015	9.4	Bj	231508			035	10.7	Ar	038	9.1	Rb	235053			039	10.2	Jo
018	10.1	Dh	990	9.4	Fc	036	10.7	Ar	038	9.1	Hf	033	12.4	Br	041	10.3	Jo
019	10.7	Ma	034	8.0	Jo	037	10.8	Ar	039	9.0	Kn	**V Cet**			052	9.6	Gy
026	9.7	Wp	039	8.2	Jo	038	10.8	Ar	039	9.0	Jo	*235209*			052	9.5	Pt
026	9.6	Wa	039	8.6	Hf	039	10.6	Jo	040	8.9	Fc	043[	12.8	Hk	053	9.3	Hf
033	9.4	Rb	041	8.2	Jo	039	10.6	Hf	040	9.5	Ma	**R Tuc**			**W Cet**		
035	9.3	Hk	042	8.5	Mc	040	10.3	Ma	041	8.9	Jo	*235265*			*235715*		
036	9.7	Hk	045	8.3	Bj	041	10.7	Jo	041	9.0	Hf	012	9.7	Ht	038	9.7	Hf
036	9.3	Bj	047	8.4	Jo	042	10.7	Pb	042	8.9	Bu	013	9.5	dK	043	10.5	Hk
036	9.4	Fc	051	8.8	Mc	042	10.7	Ar	042	8.5	Bj	020	9.9	dK	043	10.5	Dh
038	9.6	Hk	052	8.2	Pt	043	10.6	Ar	043	8.8	Dh	027	10.5	dK	**Y Cas**		
038	9.9	Ma	053	8.9	Hf	043	10.7	Pb	043	8.7	Hk	040	11.6	dK	235855		
039	9.3	Wa	**RY And**			044	10.7	Ar	044	9.0	Jo	**R Cas**			033	9.7	Br
041	9.1	Hf	231539			045	10.7	Ar	047	8.8	Rb	235350			039	10.0	Jo
041	10.1	Ac	996	12.3	Hk	052	10.7	Pt	048	8.8	Jo	009	10.5	Ah	041	10.3	Jo
041	9.4	Jo	004[	12.3	Hk	053	10.7	Hf	050	8.4	Rb	033	10.3	Br	**SV And**		
042	9.7	Hk	035	12.4	Hk	**ST And**			052	8.7	Jo	033	10.3	Dl	235939		
043	9.6	Hk	038	12.7	Ma	233335			052	8.5	Gy	038	10.4	Dl	033	9.7	Jo
045	9.6	Hk	038	12.7	Hk	034	10.7	Jo	052	8.2	Pt	038	10.5	Hf	039	10.0	Jo
046	9.4	Mc	042	12.3	Hk	039	10.3	Jo	053	8.1	Wp	038	10.5	Wd	039	10.2	Br
047	9.5	Jo	045	12.5	Hk	039	10.5	Hf	053	8.4	Wa	039	9.7	Jo	040	10.7	Ma
053	9.7	Hf	053	13.0	Wa	041	10.4	Jo	054	8.7	Si	041	9.6	Jo	041	10.2	Jo
056	9.5	Wp	**V Phe**			047	9.8	Jo	054	8.6	By	043	10.1	Wd	042	10.7	Hk
056	9.2	Cm	*232746*			052	10.2	Pt	**Z Cas**			045	10.0	Je	044	10.4	Bj
056	9.3	Wa	012	11.0	Ht	053	10.1	Hf	233956			048	9.2	Jo	052	11.0	Pt
									015	10.7	Hk						

Rapidly Varying Irregular Variables

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX Andromedae—							005840 RX Andromedae—						
	8000.6	12.1	Fc	8035.5	11.9	Ry		8043.4	10.6	Fc	8050.9	13.0	Pt
	8003.5	11.2	Fc	8035.7	12.0	Ar		8043.9	11.1	Ar	8051.8	12.8	Pt
	8004.6	11.1	Fc	8035.8	12.5	Br		8044.5	11.5	Ry	8052.6[	12.5	Gy
	8006.6	11.9	Fc	8036.4	13.0	Fc		8044.6	11.5	Jo	8053.6	13.3	Wp
	8010.7	12.6	Hf	8036.5	12.7	Ry		8045.7	11.0	Ar	8053.6	13.2	Wa
	8016.5	12.2	Ry	8036.7	13.0	Ar		8046.8	12.2	Br	8055.8	10.8	Es
	8018.4	13.0	Ry	8037.4	13.0	Ry		8048.6[	12.0	Jo			
	8019.4	12.3	Ry	8037.6	13.5	Wp	020356 UV Persei—						
	8020.5	11.9	Ry	8037.8	13.3	Ar		8035.8[	13.5	Br	8042.8[	13.9	Br
	8021.5	11.3	Ry	8038.6	12.0	Jo		8039.8[	12.7	Br	8046.8[	12.7	Br
	8022.5	11.3	Ry	8038.7	13.3	Ar		8041.8[	13.9	Br			
	8026.8	13.3	Ar	8038.9	13.0	Pt	060547 SS Aurigae—						
	8027.7	13.2	Ar	8039.8	13.2	Br		8006.6	11.3	Fc	8037.4[	11.5	Ry
	8028.7	13.1	Ar	8040.5	13.0	Fc		8016.6[	13.2	Ry	8040.5[	13.9	Fc
	8029.7	13.1	Ar	8040.9	12.9	Pt		8018.6[	13.8	Ry	8042.9	14.6	Ar
	8031.4[	11.3	Ry	8041.8	13.3	Br		8019.5[	13.2	Ry	8043.9	14.0	Ar
	8032.7	11.0	Wp	8042.5	12.8	Ry		8021.5[	13.2	Ry	8044.5[	13.2	Ry
	8032.7	10.8	Wa	8042.8	12.0	Br		8022.5[	12.5	Ry	8051.9[	13.2	Bj
	8034.6	11.7	Jo	8042.8	12.1	Ar		8026.9	14.3	Ar	8054.9[	13.8	Bj
	8034.9	11.6	Pt	8042.9	12.8	Pt		8036.5[	11.5	Ry	8056.9[	12.5	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
074922 U GEMINORUM—						
	8042.9	14.1	Ar	8054.9[	13.8	Bj
	8043.9	13.8	Ar	8056.9[	13.3	Pt
	8051.9[	13.3	Bj			
081473 Z CAMELOPARDALIS—						
	8016.4	10.4	Ry	8037.4	12.0	Ry
	8018.4	10.4	Ry	8037.6	11.1	Kn
	8019.4	10.8	Ry	8037.6	11.3	Wp
	8020.4	10.9	Ry	8037.7	11.7	Ar
	8020.6	10.9	Kn	8038.6	10.7	Kn
	8020.7	10.9	Md	8038.6	10.9	Ar
	8021.5	11.1	Ry	8038.7	11.1	Pt
	8022.4	11.4	Ry	8039.6	10.4	Wp
	8022.8	11.7	Md	8039.6	10.9	Kn
	8023.8	11.9	Md	8040.4	10.7	Ry
	8026.6	12.2	Wa	8040.7	11.2	Pt
	8026.6	12.8	Ar	8040.8	11.0	Jo
	8026.6	12.2	Wp	8041.6	11.3	Kn
	8027.6	12.6	Ar	8042.5	11.2	Ry
	8028.6	12.4	Ar	8042.6	11.7	Ar
	8029.7	12.6	Ar	8042.7	11.0	Pt
	8031.6	12.7	Wa	8043.6	11.5	Kn
	8032.6	13.2	Wa	8043.9	11.5	Ar
	8034.6	13.3	Wp	8044.5	11.7	Ry
	8034.7	12.6	Pt	8045.7	12.3	Ar
	8035.6	13.3	Ar	8050.7	12.6	Pt
	8036.6	12.6	Ar	8051.7	12.8	Pt
	8036.7	12.8	Md	8052.8	12.6	Jo
094512 X LEONIS—						
	7986.3[	11.8	Ks			
180445 NOVA HERCULIS—						
	7887.5	4.2	Mi	7993.0	7.7	SS
	7940.8	10.5	Ma	7994.0	7.7	SS
	7941.8	10.3	Ma	7994.3	7.5	Fc
	7947.7	9.5	Ma	7994.4	7.5	Fc
	7948.8	9.8	Ma	7994.7	7.5	Ra
	7949.8	9.7	Ma	7995.4	7.5	Fc
	7951.7	9.7	Ma	7995.6	7.5	St
	7953.7	8.5	Si	7996.4	7.5	Fc
	7955.7	8.9	Ma	7996.7	7.2	Ma
	7977.7	7.9	Ma	7996.9	6.8	Hk
	7985.6	7.9	St	7997.4	7.5	Fc
	7985.9	7.0	Si	7998.2	6.9	Ch
	7986.6	7.8	St	7999.4	7.6	Fc
	7986.8	7.3	Mi	7999.5	7.7	Fc
	7987.3	7.4	Fc	7999.7	6.7	Mg
	7987.4	7.4	Fc	8000.3	7.3	Fc
	7987.6	7.9	St	8000.6	7.5	Fc
	7988.4	7.4	Fc	8000.6	7.3	Ma
	7989.2	6.8	Ch	8001.2	7.5	SS
	7989.4	7.4	Fc	8001.6	7.5	Fc
	7989.6	6.8	Bb	8002.0	7.6	SS
	7989.6	7.0	Mb	8002.6	7.3	St
	7989.6	6.8	Mg	8002.7	7.0	Hk
	7990.4	7.3	Fc	8003.0	7.5	SS
	7990.5	7.2	Fc	8003.3	7.2	Fc
	7990.8	7.1	Si	8003.4	7.3	Fc
	7991.2	6.8	Ch	8003.4	7.8	Ap
	7991.4	7.6	Fc	8004.1	6.9	Ch
	7992.0	7.7	SS	8004.5	7.2	Fc
	7992.4	7.2	Fc	8004.6	6.5	Mg
180445 NOVA HERCULIS—						
	8004.6	7.1	Fc	8018.8	6.7	Dh
	8005.0	7.6	SS	8018.8	6.4	Hi
	8005.4	7.1	Ks	8019.0	6.8	SS
	8006.1	6.8	Ch	8019.0	6.6	SE
	8006.4	7.6	Ks	8019.6	6.4	Mg
	8006.6	7.6	Fc	8019.7	6.8	Kp
	8007.0	7.6	SS	8019.7	7.3	Cl
	8007.2	7.5	SS	8019.7	7.3	Mo
	8008.0	7.4	SS	8019.8	6.3	Ma
	8008.2	7.3	SS	8019.8	6.3	Hi
	8008.6	7.1	St	8020.4	7.7	Ks
	8009.1	7.4	SS	8020.6	6.6	Kp
	8009.2	7.4	SS	8020.6	7.4	Sa
	8009.3	7.3	Ks	8020.6	7.2	Sq
	8009.6	7.1	St	8020.7	6.4	Hi
	8010.2	7.2	SS	8020.8	7.1	Md
	8010.4	7.5	Ap	8020.8	6.5	Br
	8010.4	7.4	Ks	8021.0	6.8	SS
	8010.7	7.0	Hk	8021.3	7.6	Ap
	8011.4	7.6	Ks	8021.3	7.4	Ks
	8011.6	7.2	St	8021.6	7.0	Kt
	8011.8	6.5	Ma	8021.6	7.3	St
	8012.1	7.1	SS	8021.6	7.1	C
	8012.2	7.1	SS	8021.8	6.4	Hi
	8012.6	7.2	St	8022.1	6.8	SS
	8012.6	6.5	Mg	8022.6	6.4	Bb
	8012.6	6.7	Bb	8022.6	7.2	St
	8013.1	6.7	SS	8022.6	6.4	Mg
	8013.4	7.6	Ap	8022.6	7.1	C
	8013.4	7.6	Ks	8022.7	7.0	Md
	8013.8	6.4	Ma	8022.7	6.5	Hi
	8013.8	6.8	Mi	8022.8	6.8	Br
	8014.3	7.4	Ks	8023.0	7.1	SS
	8014.6	7.2	St	8023.1	6.9	SS
	8015.1	6.9	SS	8023.3	7.6	Ap
	8015.2	7.0	SS	8023.4	7.5	Ks
	8015.3	7.6	Ks	8023.5	7.0	Sa
	8015.4	7.6	Ap	8023.6	7.2	C
	8015.6	6.5	Bb	8023.6	7.2	St
	8015.6	6.4	Mg	8023.6	6.9	Kt
	8015.6	7.3	St	8023.7	6.5	Hi
	8015.7	6.5	Hk	8023.8	7.1	Md
	8016.0	7.5	SS	8024.3	7.6	Ap
	8016.3	7.4	Ks	8024.4	7.6	Ks
	8016.6	6.5	Mb	8024.6	6.4	Rb
	8016.6	6.4	Mg	8024.8	7.1	Md
	8016.7	6.8	Sa	8025.3	7.5	Ks
	8017.0	7.7	SS	8025.7	7.0	Md
	8017.1	7.3	SS	8025.7	6.4	Hi
	8017.6	6.4	Mg	8026.4	7.5	Ks
	8017.7	6.4	Hi	8026.6	6.4	Wp
	8018.1	6.8	SE	8026.6	6.7	Wa
	8018.0	7.2	SS	8026.7	7.0	Md
	8018.1	7.1	SS	8026.7	6.5	Hi
	8018.1	6.8	Ch	8026.7	6.1	Ar
	8018.4	7.5	Ks	8027.6	7.2	St
	8018.6	6.4	Mg	8027.6	6.5	Wp
	8018.6	6.5	Mb	8027.7	7.0	Md
	8018.6	6.4	Bb	8027.7	6.2	Ar
	8018.7	7.2	Kt	8028.4	7.6	Ks

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
180445 NOVA HERCULIS—							180445 NOVA HERCULIS—						
	8028.6	6.4	Ar	8034.9	6.9	Rc		8039.6	6.4	Mg	8044.1	7.0	SS
	8028.7	7.0	Md	8034.9	7.0	To		8039.6	6.3	Bb	8044.3	7.3	Fc
	8028.7	7.1	Kt	8035.3	7.2	Fc		8039.7	7.4	Jo	8044.6	6.4	Rl
	8029.6	7.1	Kt	8035.3	7.5	Ap		8039.7	7.1	Es	8044.6	6.3	Hm
	8029.7	7.0	Md	8035.5	7.1	Fc		8039.7	7.1	Wg	8044.6	7.4	Jo
	8029.7	7.1	Es	8035.7	6.2	Dh		8039.7	6.4	Hi	8044.7	6.4	Hi
	8029.7	7.1	Pf	8035.6	6.4	Bu		8039.7	7.3	Md	8044.7	7.0	Es
	8029.7	6.5	Hi	8035.7	6.4	Hi		8039.7	6.7	Wa	8044.8	7.0	Md
	8029.7	6.1	Ar	8035.7	7.1	Md		8039.7	7.3	Mo	8045.0	6.9	SE
	8029.8	6.5	Rb	8035.7	6.4	Ar		8039.8	6.8	Br	8045.0	7.0	SS
	8030.0	6.9	SS	8035.7	7.0	Kt		8039.9	7.2	Cm	8045.3	7.4	Ks
	8030.6	6.8	C	8035.7	6.2	Dh		8039.9	6.9	Rc	8045.3	7.2	Fc
	8030.6	6.8	Kt	8035.8	7.3	Es		8040.0	6.9	SS	8045.4	7.2	Fc
	8030.6	6.5	Rb	8036.0	6.9	SE		8040.5	7.0	Fc	8045.6	7.1	Se
	8030.7	7.0	Es	8036.0	6.8	SS		8040.6	7.8	Sq	8045.6	7.6	Sa
	8030.7	7.1	Ca	8036.3	7.2	Fc		8040.6	6.7	Hm	8045.6	7.0	Kt
	8031.2	6.9	SS	8036.4	7.1	Fc		8040.7	7.1	Es	8045.7	6.9	Md
	8031.4	7.4	Ks	8036.6	6.7	Ar		8040.7	7.3	Mo	8045.7	6.9	Es
	8031.6	6.5	Wd	8036.7	7.1	Ba		8040.7	6.9	Dh	8045.7	6.3	Ar
	8031.6	6.6	Wp	8036.7	7.2	Sx		8040.7	7.0	Kt	8046.4	7.4	Ks
	8031.6	6.6	Wa	8036.7	7.1	Md		8040.7	6.9	Ku	8046.4	6.8	Fc
	8031.6	6.6	Hm	8036.7	7.3	Es		8040.7	7.3	Jo	8046.6	7.6	Sa
	8031.7	7.0	Md	8036.7	7.0	Kt		8040.7	7.0	Pt	8046.6	7.0	Cx
	8031.9	6.9	Rc	8036.8	6.4	Hi		8040.8	7.0	Md	8046.6	6.5	Hm
	8032.4	7.5	Ks	8036.8	6.2	Dh		8040	6.3	Bu	8046.6	6.7	Ac
	8032.6	6.6	Wa	8036.9	7.1	Sx		8041.3	6.8	Fc	8046.8	6.2	Dh
	8032.6	6.6	Wp	8037.0	6.9	SE		8041.4	7.4	Ap	8046.9	7.0	Rc
	8032.6	6.8	Rl	8037.0	6.9	SS		8041.5	6.9	C	8047.5	6.9	Ba
	8032.6	6.9	Ba	8037.3	7.2	Fc		8041.6	7.0	To	8047.6	6.5	Rb
	8032.6	6.8	Hm	8037.7	6.7	Wg		8041.6	6.5	Rb	8047.7	7.1	Md
	8032.6	6.8	Cf	8037.6	6.8	Wp		8041.6	6.8	Hf	8048.6	7.4	Jo
	8032.6	7.2	St	8037.7	7.0	Md		8041.6	7.0	Ac	8048.6	6.5	Rb
	8032.6	6.9	Pf	8037.7	6.3	Ar		8041.6	6.4	Hm	8048.8	7.0	Md
	8032.6	6.4	Rb	8037.7	6.4	Hi		8041.7	7.0	Ba	8049.7	7.0	Md
	8032.6	6.3	Mg	8038.0	6.9	SS		8041.7	7.0	Md	8049.7	7.1	Es
	8032.6	6.3	BT	8038.0	6.8	SE		8041.7	7.4	Jo	8051.7	7.1	Pg
	8032.7	7.3	Sx	8038.3	7.1	Fc		8041.7	6.3	Mg	8051.7	7.0	Es
	8032.7	7.3	Jo	8038.6	6.3	Rb		8042.3	7.1	Fc	8051.7	7.1	Pt
	8032.8	7.1	Ra	8038.6	6.7	Hm		8042.6	6.2	Bb	8051.7	6.9	Md
	8033.1	6.6	Ch	8038.6	7.2	St		8042.6	6.4	Mg	8052.5	7.1	C
	8033.6	7.1	St	8038.6	6.5	Ar		8042.6	7.4	Cl	8052.5	7.0	Cx
	8033.6	6.9	Ba	8038.6	7.0	Sa		8042.6	6.7	Ar	8052.6	6.0	Sf
	8033.6	6.6	Sf	8038.6	6.4	Wd		8042.6	6.3	Mb	8052.6	6.5	Gy
	8033.6	7.0	Cf	8038.6	6.2	Ma		8042.7	7.0	Md	8052.6	7.0	Es
	8033.6	6.7	Hm	8038.7	6.4	Rl		8042.7	7.2	Pt	8052.6	7.0	Ba
	8033.6	6.5	Rb	8038.7	7.0	Pt		8043.3	7.1	Fc	8052.6	6.4	Hf
	8033.6	7.2	Sa	8038.7	7.1	Md		8043.4	7.1	Fc	8052.6	6.8	Wa
	8033.6	7.0	Kt	8038.7	7.4	Jo		8043.6	7.1	Se	8052.6	7.0	Wp
	8033.7	7.3	Sx	8038.7	6.4	Hi		8043.6	6.3	So	8052.7	7.5	Jo
	8033.7	6.5	Hi	8038.7	7.0	Cx		8043.6	6.3	Cy	8052.7	7.0	Pg
	8033.7	6.3	Mg	8038.7	7.1	Es		8043.6	7.6	Sa	8052.8	7.0	Md
	8033.7	7.2	Md	8038.8	6.5	Dh		8043.6	6.3	Sf	8053.6	6.3	Kg
	8033.7	7.1	Es	8038.8	7.1	Sx		8043.6	7.0	Kt	8053.6	6.4	Hm
	8034.1	6.7	Ch	8039.3	7.4	Ap		8043.7	6.8	Ac	8053.6	6.2	Cm
	8034.6	7.1	St	8039.3	6.9	Fc		8043.7	7.0	Md	8053.7	7.0	Es
	8034.6	6.8	Wp	8039.5	6.4	Rb		8043.8	6.2	Cm	8053.7	7.0	Md
	8034.7	6.4	Hi	8039.6	6.7	Wp		8043.8	6.4	Dh	8054.6	6.3	Hf
	8034.7	6.7	Pt	8039.6	6.5	Ma		8043.8	6.4	Ar	8055.7	7.0	Es
	8034.7	7.1	Es	8039.6	7.2	St		8044.0	6.9	SS	8055.8	7.0	Md
	8034.8	7.0	Ba	8039.6	7.1	Se		8044.0	7.1	SE	8055.9	7.0	Rc

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
180445	NOVA HERCULIS—					
	8056.6	6.4	Wa	8057.6	6.5	Hm
	8056.6	6.6	Hm	8057.7	7.3	To
	8056.6	6.9	Ba	8059.7	7.1	Pt
	8056.6	6.6	Wp	8060.0	6.4	Hm
	8056.6	6.7	Rl	8061.5	6.9	Ba
	8056.6	6.2	Wd	8062.6	7.3	Hb
	8056.6	6.5	Rb	8063.5	7.0	C
	8056.6	7.2	Cm	8064.6	6.8	C
	8056.9	7.0	Pt	8068.5	6.8	C
	8057.6	7.0	Cx	8069.5	6.7	C
	8057.6	6.8	Rl			
202946	SZ CYGNI—					
	8034.7	9.3	Pt	8050.7	9.4	Pt
	8038.7	9.6	Pt	8051.7	9.3	Pt
	8040.7	9.7	Pt	8056.7	9.4	Pt
	8042.7	9.3	Pt	8059.7	9.3	Pt
213843	SS CYGNI—					
	7918.9	11.0	Ma	8002.0	9.9	SS
	7919.8	10.8	Ma	8003.4	8.3	Fc
	7923.8	8.4	Ma	8004.1	8.3	Ch
	7931.8	8.5	Ma	8003.7	8.2	Hk
	7934.7	10.2	Ma	8003.8	8.4	Ku
	7940.8	11.1	Ma	8004.6	8.7	Fc
	7941.8	11.9	Ma	8005.5	8.5	Ah
	7947.7	12.0	Ma	8006.0	8.6	SS
	7948.7	12.0	Ma	8006.2	8.3	Ch
	7949.7	12.0	Ma	8006.6	8.7	Fc
	7953.7	12.0	Ma	8007.0	8.5	SS
	7955.8	12.0	Ma	8007.0	8.3	Hr
	7958.7	12.0	Ma	8007.5	8.5	Ah
	7960.7	12.0	Ma	8007.7	8.3	Sn
	7963.7	11.8	So	8007.8	8.3	Ku
	7965.7	12.0	Ma	8008.0	8.8	SS
	7976.5	11.8	Ah	8008.2	8.4	SS
	7982.6	11.8	So	8009.1	8.4	SS
	7984.5	12.0	Ah	8009.2	8.6	SS
	7985.5	12.0	Ah	8009.5	8.5	Ah
	7987.4	12.1	Fc	8010.2	8.5	SS
	7988.7	11.8	Wg	8011.9	8.7	Ma
	7989.0	11.9	Hr	8012.1	8.8	Ka
	7989.2	11.9	Ch	8012.1	8.6	SS
	7989.4	12.0	Fc	8013.1	8.8	SS
	7989.6	11.9	Mg	8013.6	9.5	Bj
	7990.2	11.9	Ch	8013.8	9.2	Mi
	7990.4	12.0	Ah	8013.8	9.7	Wo
	7990.5	12.2	Fc	8015.2	9.7	SS
	7990.6	12.0	Mg	8015.6	10.2	Bj
	7990.6	11.9	Bb	8016.4	10.6	An
	7992.1	11.9	Hr	8017.0	11.1	SS
	7992.1	11.9	SS	8018.0	11.6	SS
	7992.5	12.0	Ah	8018.7	11.8	Hv
	7993.0	12.0	SS	8018.7	11.9	Lf
	7993.5	12.0	Ah	8018.7	11.3	Kt
	7994.0	11.8	SS	8018.7	11.8	Bc
	7994.4	12.4	Fc	8018.8	11.8	Dh
	7994.7	11.9	Ra	8019.1	11.5	SS
	7995.5	12.0	Ah	8019.7	11.8	Hv
	8000.0	11.8	Hr	8019.7	11.8	Wg
	8001.1	11.3	SS	8019.7	11.8	Bc
	8001.7	11.8	Ra	8019.8	11.7	Ma
	8020.7	11.4	Wo	8037.6	11.8	Wp
	8020.8	11.6	Br	8037.6	11.7	Kn
	8021.0	12.0	SS	8037.7	11.9	Ar
	8021.6	12.0	Kt	8038.6	11.9	Hf
	8021.8	11.9	Br	8038.6	11.6	Rb
	8022.1	12.0	SS	8038.6	12.0	Jo
	8022.7	11.8	Br	8038.6	12.0	Wd
	8022.7	12.0	Ra	8038.7	11.9	Ma
	8025.6	12.0	Bc	8038.7	11.7	Ar
	8025.8	11.7	Br	8038.7	11.8	Cx
	8026.6	11.9	Wa	8038.7	12.0	Pt
	8026.6	11.9	Ar	8038.8	11.7	Dh
	8026.6	11.9	Wp	8039.6	11.3	So
	8027.6	11.9	Ar	8039.6	11.7	Wp
	8027.6	11.8	Wp	8039.6	12.0	Hf
	8028.6	11.7	Ar	8039.6	12.0	Jo
	8029.6	12.0	Hv	8039.6	12.0	Wd
	8029.7	11.8	Ar	8039.7	11.7	Br
	8031.6	12.0	Cm	8039.7	11.7	Wa
	8031.6	11.9	Wp	8039.7	11.7	Ma
	8031.6	11.9	Wa	8039.9	11.9	Cm
	8031.8	12.0	Br	8040.5	12.4	Fc
	8032.5	11.7	Rb	8040.6	12.0	Jo
	8032.6	11.8	Wa	8040.7	11.7	Br
	8032.6	12.0	Bc	8040.7	12.1	Dh
	8032.6	12.1	Cm	8040.7	11.6	Kt
	8032.6	12.0	Jo	8040.7	11.9	Pt
	8032.6	11.9	Cl	8041.5	12.0	Hf
	8032.6	11.7	Wp	8041.5	11.7	Rb
	8032.7	11.8	Ra	8041.6	11.9	Jo
	8032.7	11.8	Bj	8041.7	12.0	Hv
	8032.7	11.8	Mg	8041.7	12.0	Br
	8032.7	11.7	Pf	8041.7	11.6	Mg
	8032.7	11.8	BT	8041.7	11.0	BT
	8033.6	12.0	Kt	8041.7	11.9	Kn
	8033.6	12.0	Hf	8042.4	11.2	L
	8033.6	11.7	Rb	8042.4	12.0	Fc
	8033.6	11.9	Jo	8042.4	11.1	An
	8033.7	11.8	Mg	8042.6	11.8	Cl
	8033.7	11.6	Br	8042.6	11.7	Ar
	8034.7	11.7	Br	8042.6	11.7	Hk
	8034.6	12.0	Jo	8042.7	11.8	Pt
	8034.6	11.7	Wp	8042.7	11.7	Pb
	8034.7	11.7	Pt	8042.7	11.7	Br
	8034.8	12.0	Ba	8042.7	11.8	Mg
	8035.1	11.9	SS	8043.1	11.7	Ch
	8035.4	12.0	Fc	8043.6	11.4	Wd
	8035.6	11.3	Bj	8043.6	11.6	Cy
	8035.7	11.2	Kt	8043.6	11.6	So
	8035.7	11.7	Ar	8043.6	11.7	Hk
	8035.7	11.6	Br	8043.7	11.6	Pb
	8035.8	11.6	Md	8043.7	11.5	Kn
	8035.8	11.7	Dh	8043.7	11.3	Kt
	8036.1	11.3	SS	8043.7	11.5	Br
	8036.7	11.9	Lf	8043.8	11.6	Cm
	8036.7	12.0	Hv	8043.8	11.6	Dh
	8036.7	11.8	Ar	8043.9	11.7	Ar
	8036.7	12.0	Bc	8044.1	11.6	SS
	8036.7	11.4	Kt	8044.4	11.6	Fc
	8036.8	11.6	Md	8044.6	11.9	Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
213843 SS CYGNI—							213843 SS CYGNI—						
	8044.6	11.4	Bj	8047.6	11.9	Rb		8052.6	9.8	Wa	8056.6	9.2	Wp
	8045.1	11.8	SS	8047.6	12.0	Jo		8052.8	9.8	Jo	8056.6	9.2	Wa
	8045.4	11.5	Fc	8048.6	12.0	Jo		8052.8	9.8	Gy	8056.7	9.2	Pt
	8045.6	11.8	Bc	8050.6	11.3	Rb		8053.5	9.7	Hf	8056.8	9.3	Cm
	8045.6	12.2	Kt	8050.7	11.5	Pt		8053.6	9.5	Wp	8057.6	9.1	Cx
	8045.6	11.8	Kn	8050.8	11.4	Es		8053.6	9.7	Wa	8057.6	9.4	Pf
	8045.7	11.8	Hv	8051.7	10.2	Pt		8053.8	9.5	Md	8057.8	8.9	Cm
	8045.7	11.9	Ar	8052.5	9.8	Hf		8054.5	9.1	Hf	8059.6	9.2	Pf
	8046.7	11.6	Br	8052.6	9.8	Pf		8056.5	9.3	Rb	8059.7	9.2	Pt
	8046.8	11.8	Dh	8052.6	9.9	Wp		8056.6	8.7	Wd	8060.7	9.2	Pf
											8061.6	9.6	Pf

SUMMARY FOR SEPTEMBER, 1935.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Adamopoulos	Ap	15	27	Holly	Hs	8	10
Ahnert	Ah	33	173	Holt	Hb	12	15
Ancarani	An	5	14	Houghton	Ht	72	320
Andrews, J. S.	Ac	3	5	Howes	Hv	21	114
Armfield	Ar	35	198	Huruhata	Hr	5	24
Baldwin	Bl	30	39	Jansen	Je	10	18
Ballhaussen	Ba	24	43	Jones	Jo	142	447
Belsham	Bj	95	152	Kaho	Ka	2	6
Benini	Be	1	1	Katz, A.	Kv	6	21
Blunck	Bu	22	35	Katz, Y.	Ky	4	7
Brady	By	6	6	Kernan	Ke	8	16
Brocchi	Br	56	95	Keuziah	Ku	8	57
Brockmeyer	Bk	10	18	King	Kg	15	22
Brown, R. G.	Bb	3	9	Kirkpatrick	Kp	14	30
Brown, S. C.	Bs	2	2	Knott	Kt	8	43
Buckstaff	Bc	21	117	de Kock	dK	31	110
Butler, C.	BT	4	5	Koons	Kn	55	65
Callum	Cl	20	35	Kotsakis	Ks	61	148
Cameron	Ca	6	6	Lacchini	L	4	4
Campbell	C	1	10	Loepfe	Lf	3	5
Chandra	Ch	62	96	Loreta	Lt	21	65
Chartier	Cr	1	1	Marsh	Ma	63	164
Christman	Cm	75	106	McLeod	Mc	33	96
Cilley	Cy	5	5	Mennella	Mn	1	1
Cox	Cx	3	6	Miczaika	Mi	2	6
Cuffey	Cf	1	2	Millard	Md	38	185
Dafter	Df	7	29	Miller	Mw	4	5
Dalton	Dt	4	14	Monnig	Mg	12	32
Diedrich	Dh	35	132	Morse	Mb	5	8
Doolittle	Dl	22	77	Peck	Pb	8	23
Ellis	Es	59	188	Peltier	Pt	183	248
Ensor	En	54	132	Preucil	Pf	12	22
Fish	Fs	6	6	Purdy	Pg	7	9
Focas	Fc	126	304	Raphael	Ra	20	32
Friton	Fn	1	6	Recinsky	Rc	9	23
Gaebler	Gb	1	2	Reynolds	Rl	7	14
Gregory	Gy	38	40	Rosebrugh	Rb	27	79
Halbach	Hk	76	200	de Roy	Ry	10	56
Hamilton	Hm	21	118	Salanave	Sx	8	18
Hartmann	Hf	103	189	Sasabe, B. M.	SE	2	12
Harper	Hq	7	7	Sasabe, S.	SS	14	220
Heines	Hh	8	14	Scanlon	So	24	42
Hickerson, J.F.	Hc	3	3	Schattle	SC	2	3
Hildom, A.	Hi	19	46	Schmid	Sn	9	20

SUMMARY FOR SEPTEMBER, 1935—Continued.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Seely	Sa	5	22	Thomas	To	1	3
Segers	Ss	9	16	Treadwell	Td	4	22
Setzer	ST	4	4	Wade	Wh	11	14
Shinkfield	Sl	1	3	Walton	Wu	4	4
Shultz	Sz	6	7	Washburn	Wo	3	4
Simpson, J.W.	Si	24	59	Watson, P.	Wa	34	82
Smiley	St	1	20	Webb	Wd	49	70
Smith, F.P.	Sq	10	16	Williamson, A.	Wg	8	16
Smith, F.W.	Sf	13	16	Woods	Wp	26	98
Smith, L.	Sh	3	3				
Starnes	Se	7	18	Totals		108	435	6075

gathering power the Nova appears to be brighter than when seen in larger telescopes. In a final discussion of the star, a correction may have to be made to overcome this difficulty.

LEON CAMPBELL, Recorder.

October 12, 1935.

Meteor Notes from the American Meteor Society

By CHARLES P. OLIVIER, President

In 1933 on the night of November 15-16 Alfred Boyles, of Ensley, Alabama, succeeded in photographing a Leonid which was simultaneously photographed by W. G. Montgomery at a station about 7½ miles distant. The two plates were sent to this office by Boyles, and have now been measured. The height of the middle of the two photographed trails has been deduced.

The stations at which the cameras were placed were:

No.	Place	Long.	Lat.	Photographer
1	Ensley, Ala.	86° 53′ 56″	33° 30′ 13″	A. Boyles
2	Birmingham, Ala.	86 46 10	33 31 00	W. G. Montgomery

The line distance from a U. S. topographic survey map is 7.48 miles. A kodak was used at Station 1, and a B. and L. objective at Station 2. Both cameras were held stationary and the stars allowed to trail during an exposure of about an hour. Eastman 40 plates were used at both stations, taken from the same box and developed together in the same tank. The meteor which was recorded on the plates appeared at 15:18:58, C.S.T., and was plotted from a visual observation at Station 1, where Boyles recorded it as of magnitude 1, duration 2/10 sec, duration of train 2 sec, color blue-green, path length about 5°.

The plates were measured independently by Mrs. Wills and by me. We used a transparent plate rack, a Harvard Repsold-square plate, and a Bausch and Lomb eyepiece containing a scale graduated to tenths of millimeters. The end points of the trail were measured with respect to five stars. From these measures mean positions were found for the end points, and the midpoints of the trails were placed with respect to the stars. The midpoint positions as found on the two plates were as follows:

Station No.	R.A. 1933.874 h m s	Decl. 1933.874 ° ′
1	9 24 47	+21 27.1
2	9 01 38	21 53.8

The midpoint of the trail as plotted from Station 1 is at $9^h\ 27^m1$, $+20°.6$ (1900). This indicates very excellent plotting by Boyles.

The true height of the midpoint of the trail was found by Schaeberle's method to be 100.1 ± 0.1 km. To check the accuracy of our usual semi-graphical method of solving for heights, an independent solution was made using that method. The resulting height was 100.4 km, in beautiful agreement with the Schaeberle result. This gives us added confidence that in most cases the shorter method is fully competent to give the necessary accuracy.

Although the visual length of the path from Station 1 was about 5°, only 0° 59′ of trail was recorded on plate 1: about 1° 34′ of trail was recorded on plate 2. The ends of the trail on both plates were extremely faint and difficult to measure. Assuming the height of 100.1 km to be correct, the length of the path as photographed at Station 1 is about 17 km, and at Station 2, about 28 km. This difference illustrates most forcibly the present fundamental difficulty with the photographic determination of meteor heights: we can never be sure that the same absolute points of the meteor's trail appear as ends on both plates. Also we know that only the brighter portion of the path, very probably where the train lasts longest, will be photographed. That the meteor here discussed left a 2-second train is probably one chief reason why it registered at all. The height is just within the upper limit of the stratum where long-enduring trains are expected.

The method of reduction of the plates is one doubtless well known to astronomers but not to many amateurs. A description of it will be published in a coming number of these "Notes."

The success of this well-planned piece of work by Boyles should encourage other amateurs to undertake simultaneous photographic observations. We consider the height here obtained one of the most reliable on record, the credit obviously being due to the observers.

This November gives us the last probable chance for a fairly rich shower from the Leonid stream until nearly thirty years hence. The moon will be at last quarter and near the radiant on November 18. As the most probable nights for maximum should be November 15-16 and 16-17, moonlight will certainly interfere with any display. However, it is of capital importance to obtain more data on long-enduring trains; and as the Leonids usually furnish some of these when they appear in considerable numbers, this last opportunity should not be missed. We therefore request our A.M.S. members to observe on the above nights. Those who can arrange for duplicate observations with others who are from 20 to 100 miles distant should by all means do so. Because of the interference of moonlight, only bright meteors are likely to be seen from both stations. Attention should therefore be fixed upon these if a good total number of meteors appear. But if a long-enduring train is left, everything else should be dropped while complete drawings of this at one-minute intervals are made, with other notes and observations which are useful. Opera glasses will be an aid in following such trains longer than the naked eye permits.

Members who need advice or maps and blanks should write at once, not wait until the last minute. Although no grand shower is expected, we are not quite sure what may happen; and if there is a favorable return, we most certainly should be fully prepared.

Flower Observatory of the University of Pennsylvania,
Upper Darby, Pennsylvania, 1935 October 22.

Contributions from the Society for Research on Meteorites

Edited by FREDERICK C. LEONARD, President, *and* H. H. NININGER, Secretary

"On the Fall of the Podkamennaya Tunguska Meteorite in 1908,"

By L. Kulik*

Translated by LINCOLN LA PAZ *and* GERHARDT WIENS,
of The Ohio State University

In the month of February, 1927, an expedition, with the author as leader, was equipped by the Academy of Sciences of the U.S.S.R. for the investigation of the place of fall of the meteorite of June 30, 1908, in the basin of the upper part of the Podkamennaya Tunguska river.

In the latter part of March, 1927, I began my investigations to the north of the Podkamennaya Tunguska, having my base at the factory [trading post] Vanovara, lying near this stream in approximately the 72° of longitude east of Pulkovo. After repeated attempts to penetrate the marshy forests north of this river,

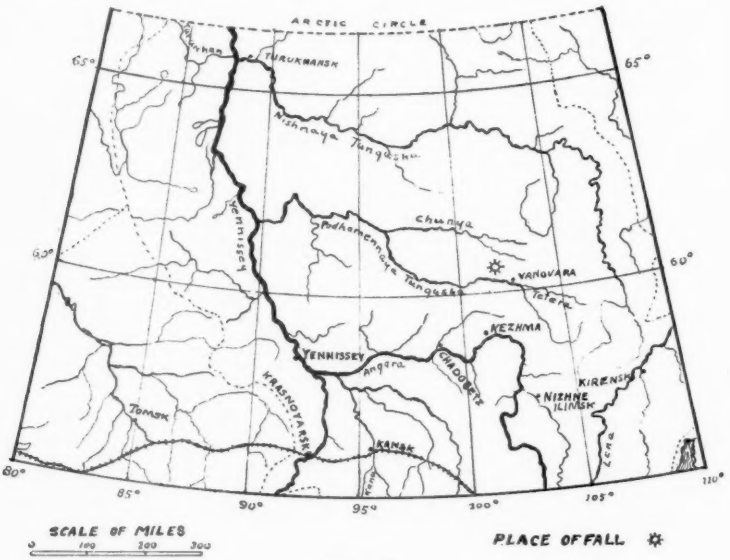


Fig. 1

MAP OF THE PLACE OF FALL OF THE PODKAMENNAYA TUNGUSKA METEORITE IN 1908

*Published originally in the *Journal of the Russian Academy of Sciences*, 1927A, pp. 399-402; read by the Academician V. I. Vernadsky on Nov. 7, 1927.

Translated from the Russian of L. Kulik by Gerhardt Wiens, Department of German, The Ohio State University, at the suggestion and with the coöperation of Lincoln La Paz, Department of Mathematics, The Ohio State University. Words inclosed in square brackets have been inserted by the translators.

advancing to the northwest on small rivers by means of a raft, I reached the central part of the area of the fall in the month of June and made a hurried survey of the place and its neighborhood.

On account of the absence within hundreds of kilometers of any astronomical points and because of the complete unreliability of the maps available for this region, I can only approximately determine the place of fall as lying in 61° north latitude and in 71° east longitude from Pulkovo; [In 1934, the accurately determined coördinates of the place of fall were given by I. S. Astapowitsch (*Quar. Jour. Roy. Meteorol. Soc.*, **60**, pp. 493-504) as lat. 60° 54′ N., long. 101° 57′ E. of Greenwich.] *i.e.* about a hundred kilometers to the northwest of Vanovara [see Fig. 1].*

The central part of the fall, lying on the plateau which forms the watershed between the basin of the river Chunya [Chuna] and the Podkamennaya Tunguska proper, consists of an area several kilometers in diameter which has the appearance of a huge crater surrounded by an amphitheatre composed of chains of hills and isolated peaks. To the south, along a tangent to this circle of mountains, the river Khushmo, the right hand tributary of the river Chamba, which enters the Podkamennaya Tunguska about 30 km below Vanovara, flows from west to east. This system of tributaries was for the most part my road from Vanovara to the place of fall and back. In the previously mentioned crater, there are in turn chains of hills and isolated peaks, marshy plains, swamps, lakes, and small streams. Very recently, according to the testimony of local residents, there was here a typical marshy woods. At present the entire marshy woods inside and outside of the crater is practically destroyed, being altogether blown to the ground, where it lies in generally parallel rows of trunks (stripped of branches and bark), the tops of the trunks pointing in the direction away from the center of the fall; this peculiar "fan" of broken-down woods can be especially well seen from the summits of the chains of hills and individual heights which form a peripheral ring about the basin. However, here and there the marshy woods remained in the form of trunks standing on their roots (usually without bark and branches). Similarly, in spots, unimportant strips and small copses of green trees remained. But these exceptions are a rarity and can be easily explained in every individual case. The whole former vegetation of both the crater and the surrounding hills, as well as the zones for several kilometers around them [the hills], carries the characteristic traces of a uniform and continuous burning not resembling the effects of an ordinary [forest] fire; moreover, this burning is shown on the broken-down trees as well as on the standing trees [and] on the remnants of bushes and moss on the summits and the sides of the hills as well as in the marshy plains and on the isolated islands of dry land in the midst of the swamps covered with water. The area with traces of burning is several tens of kilometers in diameter. The central region of this "burned" area, which measures several kilometers in diameter, exhibits in that part of it which is occupied by marshy plains covered with bushes and woods, traces of something like a sidewise pressure which gathered up the soil and vegetation in flat folds with depressions several meters deep, drawn out on the whole perpendicularly to the northeast direction. Moreover, this region is strewn with dozens of freshly formed flat "craterlets" [funnels], which have various diameters, ranging from several meters to tens of meters, with a depth also of several meters; the walls of these "craterlets" are usually steep, although there are

*[The figure referred to (based on the most recent maps of the region of the fall) is substituted for the original sketch map of L. Kulik (*loc. cit.*, p. 399).]

also some sloping ones; the bottom of the craters is flat, swampy, and mossy, and carries sometimes the traces of a central eminence. On the northeast end of one of these marshy areas, the moss cover seems to be pushed several tens of meters away from the foot of a hill and replaced by a bog. Opposite, on the southwestern side of the crater, the swamp ends in a chaotic accumulation of the moss cover. A test excavation in the marshy plain of one unimportant "craterlet" (1.5 to 2.0 meters in diameter) which was filled with a tiny swamp showed: (1) that from such a "craterlet" one can pump [bail] out the water by pailfuls; (2) that at the depth of a meter from the surface of the marshy plain, at the end of June, one finds frozen peat at the bottom of the "craterlet"; (3) that the layer of water in the crater is 30 cm thick and the layer of slime under it also is 30 cm thick; (4) that the seepage of the water during twelve hours did not exceed 30 cm, *i.e.* half of the original quantity.

To the preceding, it is necessary to add that the collection of testimonies from local eyewitnesses of the fall, made by myself, gave me a number of interesting narratives from which I quote the following.

The peasant S. B. Semenov related to me in a letter:

"It was in 1908 in the month of June about 8 o'clock in the morning; I lived at that time on the Podkamennaya Tunguska at the factory Anovara (Vanovara, L. K.) and was occupied with work around my hut. I sat on the open porch with my face toward the north and at that time there arose, in a moment, a conflagration which gave off such heat that it was impossible to remain sitting—it almost burned the shirt off me. And it was such a flaming wonder that I noticed that it occupied a space of not less than two versts [one verst = 0.663 mile]. But to make up for that, this conflagration endured only a very short time; I had time only to cast my eyes in that direction and see how large it was, when in a moment it vanished . . . After this vanishing it grew dark, and at the same time there was an explosion which threw me off the open porch about seven feet or more; but I did not remain unconscious for very long; I came to myself and there was such a crashing sound that all the houses shook and seemed to move from their foundations. It broke the window panes and window frames in the houses, and in the center of the square, near the huts, a strip of earth was torn out, and at the same time the so-called shore [bracing strip] of iron on the door of the barn was broken, but the lock remained whole."

Another peasant, P. P. Kossolapov, personally informed me on March 30, 1927, that in June, 1908, at 8 o'clock in the morning, he was getting ready at the same factory to go hay cutting; he needed a nail; not finding one in the room, he went out into the yard and began pulling a nail out of a window with his pincers. Suddenly something very strongly scorched his ears. Reaching for them and thinking that the roof was burning, he raised his head and asked S. B. Semenov, who sat on the open porch at his house, "Say, did you see anything?" "How could one help seeing it?" answered the other; "It seemed to me too as if heat embraced me." P. P. Kossolapov there and then went into his house, but scarcely had he entered the room and got ready to sit down on the floor to his work when an explosion occurred, the sod fell from the ceiling, the oven door of the Russian stove broke loose and flew on to a bed standing opposite the stove, and one window pane was broken, falling into the room. After this, there was a sound similar to the rolling of thunder, vanishing gradually to the north. When it became somewhat quieter, Kossolapov rushed out into the yard but did not notice anything more.

Finally, on the 16th of April, 1927, the Tungus Luchetkan told me that the whole central region of the wind-felled trees was occupied before this event by his relative, the Tungus Vasiliy Ilyich (the brother of the mother of his first wife), who used it as a pasture for reindeer. Vasiliy Ilyich was a rich Tungus; he called up to fifteen hundred reindeer his own; he had in this region many sheds in which he kept clothes, utensils, reindeer equipment, *etc.* With the exception of several dozen tame ones, the reindeer were permitted to roam at will in the hills in the region of the river Khushmo. But down flew the fire and broke down the woods; the reindeer and the sheds were gone. Thereupon the Tunguses went in search of them. Of some reindeer they found the charred carcasses; the others they did not find at all. Of the sheds nothing remained; everything was burned up and melted to pieces—clothes, utensils, reindeer equipment, dishes, and samovars; they found only a few "kettles" [buckets] intact. All of these places are known to the brothers of Vasiliy Ilyich, Boorootsh and Moogotsh.

Other witnesses among the Tunguses and Russians asserted that: (1) the forest at the center of the fall lies in the form of a "fan," with the [tree] tops directed away from the center of the fall; in the latter, "the earth was turned up"; (2) up to the time of the fall there was here the normal green marshy woods; (3) until and after the time of the fall and the general destruction by the "fire" ["everything was black"], there were no fires at this place.

The investigation carried out by me is of a superficial character: this circumstance is due partly to the lack of time at my disposal and the limitation of supplies and partly to the lack of necessary technical means. The continuation of a detailed study of the whole region of the fall before any excavations are made, appears urgently necessary.

In the literature on meteorites, if we do not include chronicle [*i.e.* old and unreliable] accounts, there has not been until now any description of the devastation of wooded areas caused by the fall of meteorites, although references to such phenomena have been made.* In the fall of the Podkamennaya Tunguska meteorite we have the first case of a colossal breaking down of woods by wind, the detailed study of which is both possible and unconditionally necessary. Besides, we notice here, apparently for the first time in the history of meteorites, one of the rarest cases in which a large meteorite arrived at the surface of the earth without stopping at the point of retardation [disruption]; *i.e.* the case of *a contact between the surface of the earth and that cloud of incandescent gases* [*italics* ours] which surrounds a meteorite entering into our atmosphere and which accompanies it usually [only] up to the point of its retardation [disruption].* Finally, the manner in which the craters are strewn over the area of the fall, itself requires detailed study, since this fall differs from an ordinary fall, both in the mass of the material and in its relative velocity; moreover, such study will give us information concerning the choice of the place which would be most profitable for excavation. The most rational method for this purpose appears to be the execution of a photographic survey from a hydroplane [airplane]. In addition, these things are desirable: a magnetometric [magnetic] or an electric survey of the area strewn with craters; a determination of the heights of the plateau and the surrounding hills; and also the determination of several astronomical points for the control of surveys to be undertaken in this district.

*[The translators wish to express their appreciation of the kind assistance rendered by Dr. N. T. Bobrovnikoff, Perkins Observatory, Ohio Wesleyan University, in connection with the translation of this sentence.]

The Determination of Fireball Durations*

By Bemrose Boyd

Recent work has indicated the possibility of developing photographic equipment for meteor observation. When second- or third-magnitude meteors can be recorded photographically, their velocities can be measured. The development of such equipment will, however, still leave us dependent almost entirely upon estimates of duration for information concerning the velocities of meteors which drop meteorites.

A discussion of estimates of duration most logically takes the form of an enumeration of means of aiding the accurate estimation of short-time intervals. It appears that with the average observer, estimates of duration are of little value unless either such a means has been consciously applied, or the circumstances of observation have been such that some means of checking the estimates may be applied. Counting at a steady rate or repeating a memorized phrase is probably the simplest form of the conscious application of means to aid the estimation of durations. Untrained observers of very large fireballs are, however, probably too startled to apply these aids. In the numerous reports of fireball observations received at the University of Iowa Observatory, there is only one record[1] of a person's counting during the observation, and no record at all of anyone's repeating a memorized phrase. In interviewing fireball observers it has been customary for members of the Midwest Meteor Association to check the duration by means of the observer's actions at the time of observation. If he was walking in familiar surroundings and can remember how far he walked while the meteor was visible, he is taken to the place of observation and asked to walk the same distance at as nearly as possible the same rate. If the observer was not walking, he might merely move a pointer along the observed path with the apparent velocity of the meteor as he remembers it. Such re-enactments are timed with a stop-watch and different observers of the same meteor are found to agree very well in the most favorable cases. Motion of either the light or the observer gives the event an apparent extension in space as well as in time and aids in the reproduction of the duration. Cases where the observer was walking have been found especially accurate and worthy of greater weight in determining the duration.

These methods limit the inherent psychological errors and permit a certain development of skill which gives the results a value much greater than at least that of unchecked estimates. Until recently, published estimates of duration have given hyperbolic velocities in the majority of cases, but the high degree of selection attained by the Midwest Meteor Association's method of interviews has resulted in lower velocities. All well observed fireballs computed to date from these interviews have had velocities less than parabolic. This circumstance is due apparently to the use of reproduced, instead of estimated, durations and to the fact that measured azimuths and altitudes give shorter paths than do estimates.

In order to duplicate as nearly as possible the conditions of observation of a large fireball, experiments were performed, using as the light source a 110-volt, 250-watt[2] photo-flood lamp mounted on the radio mast on one of the Observatory

*A paper communicated to the Third Annual Meeting of the Society, Minneapolis, Minnesota, June 26 and 27, 1935. A brief abstract appeared in *C.S.R.M.*, *P.A.*, **43**, 465, Aug.-Sep., 1935.

[1] See *Contributions of the University of Iowa Observatory:* "The Meteor of July 25, 1929" (Second Paper), *P.A.*, **43**, 241-50, April, 1935.

[2] On account of the high efficiency of this type of bulb, its illumination is greater than that of an ordinary bulb of 500 watts.

buildings. The lamp was operated through a relay by a key in the chronograph circuit. The chronograph record gave the duration of illumination plus a small differential lag in the relay. The light was flashed without warning while sections of the class in general astronomy, or groups of visitors, were outside on the Observatory grounds. These observers were then interviewed individually, or, in some cases (as under No. (3) below), in groups of two or three. Data were obtained in the following ways: (1) The observer was asked to estimate the number of seconds the light was on. (2) The observer was asked to reproduce the interval by: (*a*) means of a key in the chronograph circuit or (*b*) tapping with a pencil to mark the beginning and end of the interval while the interviewer held a stop-watch.[2] (3) Those who were walking or performing some definite motion at the time of the observation were asked to repeat their actions at as nearly the same rate as possible. Their re-enactments were timed with a stop-watch. (4) Some of the observers were told that the light would be flashed again while they were outdoors, and were asked to count at a steady rate while it was on. Later they reproduced the interval as under No. (2) while attempting to count at the same rate.

The results of interviews by the four methods are given in the following table:

1.	Estimate	26 observers,	average error	146.6%
2.	Reproduction	26 " ,	" "	50.8%
3.	Counting	13 " ,	" "	13.8%
4.	Re-enactment	11 " ,	" "	18.3%

Some of the true intervals were approximately three seconds and some were approximately six seconds. The percentage errors of estimates and reproductions were somewhat greater for the longer intervals. The data on counting and re-enactments were not evenly divided between the short and the long intervals. For this reason and also because the circumstances were necessarily somewhat different otherwise, we cannot say definitely whether counting or re-enactment is the more accurate. Both are, however, considerably more accurate than reproduction of the intervals by an observer who was not moving, which is, in turn, better than an unchecked estimate. This result justifies the procedure used by the Midwest Meteor Association as previously described. It also indicates that it would be worth while to advise amateur astronomers and other observers to count during the appearance of a bright meteor, in order that their observations may have greater value for the determination of duration and velocity.

University of Iowa Observatory, Iowa City, June 18, 1935.

The Geographic Distribution of Mexican Meteorites—The Abundance of Siderites in the Americas[1]

By F. K. G. Müllerried[2]

Two distinct subjects are treated in this paper, as the title indicates.

[1] The abstract of a paper read September 11 before the Section for Mathematics and Physics of the Seventh American Scientific Congress, Mexico, D. F., Mexico, September 8-17, 1935. The author reports that this was the only paper on meteorites presented to the Congress.

[2] The Official Delegate of the Society for Research on Meteorites at the aforesaid Congress; see these Contributions, p. 602.

[2] No systematic difference was found between methods (2-*a*) and (2-*b*).

1. *The Geographic Distribution of Mexican Meteorites*

The Mexican meteorites, which have been found up to date, occur between the northern border line and the southern coast, with the exception of one locality which is close to the northern boundary of Lower California. In southeastern Mexico, as well as on the Gulf coastal plain and in Lower California (with the exception of the one locality already cited), no meteorites have been found. The extent of these regions is so great that the discovery of meteorites would naturally be expected there, at least in part of the territory. Meteorites have not yet been recorded, however, partly because of the limited scientific knowledge of the inhabitants of these regions, and partly because of the tropical forest and the thick soil which cover eastern and southeastern Mexico to a large extent and which make the finding of meteorites very difficult. Therefore, it is to be anticipated that in the near future a number of meteorites will be discovered in western, eastern, and southeastern Mexico, where, up to date, almost no meteorites are known; but their recovery will require explorations and investigations, probably by trained scientists.

2. *The Abundance of Siderites in the Americas*

Certain parts of the Americas are rich in siderites. Locally, the meteorites may be due to a single fall, as is the case on other continents. But there are on the American continents extensive regions, where principally meteoritic irons occur, namely the western part of the United States and Mexico, and northern Chile. A similar condition is known to prevail also in South Africa and in Australia. *All these extensive regions coincide with the arid and semi-arid parts of the Americas, Africa, and Australia, respectively.* Therefore, the abundance of siderites must have a certain relation to the climate: leaving out of account purely local falls of several or many irons, we conclude that siderites are well preserved in dry regions because oxidation and hydration are much less effective there than in humid regions, where some of the siderites have doubtless already been altered by the powerful processes of oxidation and hydration. On the other hand, we note that asiderites [aërolites] are found less in arid and semi-arid regions, probably because the typical fusion crust has either been removed by weathering or been changed by the silicification of the surface, while in a humid climate the characteristic crust has long been preserved. Accordingly, the abundance of siderites in extensive regions of the Americas (and also of Africa and Australia) must be due mainly to the satisfactory preservation of the specimens as a result of the arid and semi-arid climates, and only locally is the abundance of siderites to be ascribed to the fall of several or many meteoritic irons. Hence, the greater number of siderites in the Americas is due to their discovery in large measure in the extensive arid and semi-arid parts of North and South America, of which counterparts exist likewise in Africa and Australia. This fact means that the real proportion of siderites to asiderites [aërolites] in the Americas is probably about the same as on the other continents named.

2a del Volga 18, Mexico, D. F., Mexico.

Appointment of a Delegate to the Seventh American Scientific Congress in Mexico

Dr. F. K. G. Müllerried, of 2a del Volga 18, Mexico, D. F., Mexico, was appointed in July, by the President of the Society, as the Official Delegate of the Society for Research on Meteorites at the Seventh American Scientific Congress, held in Mexico, D. F., Mexico, from September 8 to 17, 1935.

A University Course in Meteoritics

In a private letter dated September 29, 1935, Secretary H. H. Nininger writes: "This year I have been asked to teach a course in the University of Denver under the caption of 'Meteoritics.' I shall use Farrington's books, *Our Stone-Pelted Planet,* and a host of papers as source material. Is this the first time that a course on meteorites has been offered as a study by itself? I never heard of one before. We are scheduled to meet next week, and I hope that the class will develop."

We trust that the class will materialize and also that the University of Denver will be only the first of many institutions to offer a course in meteoritics as an integral part of their curricula. —F.C.L.

Secretary's Office: The Nininger Laboratory, 1955 Fairfax Street, Denver, Colorado.

Editorial Office: The Department of Astronomy of the University of California at Los Angeles.

The Meteor of January 2, 1927

By L. R. WYLIE

At 6:03 P.M. on the evening of January 2, 1927, Mrs. John Doe (name changed), the wife of a farmer living in southeastern Iowa, was going toward the barn to help with the milking. It was quite dark and Mrs. Doe was carrying a flashlight to use occasionally. As she turned the flashlight on, the whole countryside became dazzlingly bright with a brilliant white light that swiftly turned to a greenish color. The amazed Mrs. Doe looked at her flashlight to see what had happened. She turned it off, but the light continued. Then she looked up in time to see a brilliant meteor falling in the southeastern sky.

At the same instant a Minnesota farmer had left his car to shovel away a snowdrift. At the brilliant light he turned quickly, thinking his car had caught fire. An insurance man driving near Des Moines, Iowa, thought an airplane had dropped a landing flare; and a lady in a car near Fort Madison, Iowa, thought another car had suddenly flashed its lights on them. She screamed, thinking it was a holdup.

This brilliant meteor attracted attention in five states. A request for information from those who had seen it was sent out from WSUI, the broadcasting station of the University of Iowa. More than 100 letters were received in reply, these letters coming from the states of Minnesota, Wisconsin, Illinois, Missouri, and Iowa. All letters indicate that the meteor was bright enough to startle observers.

The path through the atmosphere was in the main determined from reports from the following places: Wiota, St. Charles, Iowa City, and Dubuque, in Iowa; and Madison, in Wisconsin. The observers at Wiota and St. Charles sent charts showing the path of the meteor with respect to the stars. At Iowa City, Dr. C. C. Wylie of the University of Iowa interviewed observers. At Dubuque, Father J. A. Theobald of Columbia College personally observed the meteor, and measured the angles with an engineer's transit. At Madison, Dr. C. M. Huffer of the University of Wisconsin personally observed the meteor and sent its path with respect to known stars. Letters from certain "key towns" were also used, where the direc-

tion of the point of bursting or point of appearance coincided with one of the cardinal directions, or where the apparent slope of the path was vertical.

The Bursting Point.

The location of the bursting point was determined by reports from the following places:

Station	Weight
Madison, Wisconsin	1.3
Wiota, Iowa	1.0
St. Charles, Iowa	1.3
Burlington, Iowa	8.0
Rock Island, Illinois	5.0
Farmington, Iowa	3.0

The weights assigned are approximately proportional to the distance of the observer from the end point. The location of the projection of the bursting point was found to be longitude 90° 32′.2, and latitude 40° 50′.4. This is a point in Illinois about 25 miles east of Burlington, Iowa, and approximately 40 miles south of Rock Island, Illinois. It is about six and one-half miles southeast of Monmouth, Illinois.

For the height of bursting, the reports from Madison, Wiota, and St. Charles were used. The Madison report, being from a professional astronomer, was given double the weight of each of the others. The height of bursting was found to be 22 miles. This figure is consistent with the fact that no detonations were reported. Although many of the letters speak of a "swishing sound" (presumably a psychological illusion) as the meteor went over, none of the letters indicate noticeable detonations. The fact that people living near the bursting point took less interest than persons farther removed certainly indicates that there were no pronounced detonations. This in turn suggests that no meteorites of appreciable size reached the earth.

The Radiant.

For the determination of the radiant, the following reports of the apparent slope of the path were used. Unit weight was assigned to each.

Station	Slope
Dubuque	49°.2
Madison	32.5
Iowa City	85
Jessup	90
Walker	90

The radiant as determined by these observations was altitude 23° 31′.5, and azimuth 144° 15′.0 from the south point. This is the radiant as seen from the projection of the bursting point.

The ground point was found to be longitude 89° 57′.8, and latitude 40° 14′.2, a point near Poplar City, Illinois. The distance from bursting to ground point was found to be 55.4 miles, and the projected distance 50.8 miles. The radiant, reduced to the ground point, corrected for zenith attraction and diurnal aberration, and reduced to right ascension and declination is $\alpha = 259°.0$, $\delta = +52°.8$. This is a point near the head of Draco.

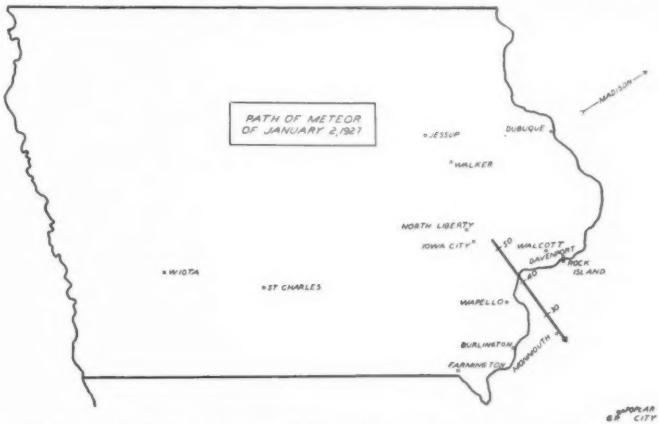
Noticeable Illumination.

The point at which the meteor became bright enough to cause people to look up is not well fixed. Most writers gave, instead of this, the direction from which the meteor apparently came. However, the Dubuque report included the length

of path, and the St. Charles observer noted that the meteor when first seen was nearly due east. A few other letters noted the appearance as in a cardinal direction of "nearly overhead." We adopted longitude 91° 18′ and latitude 41° 38′. This is a point nearly due east of Iowa City, Iowa. The meteor was 52 miles high at this point, and it travelled 74.4 miles from this point to bursting. The projected distance from illumination to bursting was 67.3 miles.

VELOCITY.

Seven values for the duration of flight were available. There were four from Dubuque and one each from St. Charles, Walcott, and Davenport. The Dubuque estimates were not included in Father Theobald's original report, which was mailed to us promptly, but were obtained by Father Theobald some weeks later when the preliminary reductions on the meteor had been completed at the Univer-



sity of Iowa. Although they were obtained by having the observer attempt to reproduce the interval, it was thought they should be given less weight than those furnished promptly. The estimates were:

Station	Duration	Weight
Dubuque	4.3 sec	2
St. Charles	3.0	1
Davenport	4.0	1
Walcott	6.0	1
Mean	4.3	

This value for the duration from noticeable illumination to bursting yields 17.3 miles per second for the observed velocity, and 22.3 miles per second for the heliocentric velocity. This is definitely less than parabolic velocity, so the meteor was probably a member of the solar system before its fall.

BRIGHTNESS.

The brightness of the meteor is indicated by a few quotations from letters received: "I could see the barbs on my fence." "It was as bright as a strong automobile headlight 20 rods away." "I thought for a few seconds that it was the lights of a car nearby." "It turned darkness into light." "It was like a flash of green lightning, but lasted longer." "The surrounding darkness suddenly burst

into white light and I found myself standing in the black shadow cast by the building."

Another indication of brightness is the fact that nearly all observers thought the meteor must be quite close. "It was not over 75 feet high when it passed" is a typical report. It would seem that near its path, the illumination of the meteor must have been equal to that of the full moon.

SUMMARY.

The accompanying chart shows the path as computed. The results are summarized in tabular form, as follows:

Longitude of Bursting Point	90° 32′.2	
Latitude of Bursting Point	40 50.4	
Height of Bursting Point	22	miles
Longitude of Appearance	91° 18′.5	
Latitude of Appearance	41 37.6	
Height of Appearance	52	miles
Length of Path	74.4	miles
Projected Length of Path	67.3	miles
Apparent Velocity	17.3	miles
Heliocentric Velocity	22.3	miles
Azimuth from south of uncorrected radiant	144° 37′.0	
Altitude of uncorrected radiant	22 47.4	
Right Ascension of corrected radiant	259°.0	
Declination of corrected radiant	+52.8	

The author wishes to express his thanks to M. P. Roller, a student at the University of Iowa, for checking the computations on this meteor; and to Dr. C. C. Wylie of the University of Iowa, for putting the fundamental data on this meteor at the author's disposal.

State Teachers College, Charleston, Illinois.

Comet Notes

By G. VAN BIESBROECK

The protracted absence of comets visible in ordinary instruments continues. We know at present of only two faint ones and they require larger telescopes for observation.

COMET VAN BIESBROECK (1935 *d*) has remained practically without change as was expected. When last recorded here (October 20) it appeared still as a round coma some 20″ in diameter showing a slight central condensation. The total brightness was estimated as $14^{M}.5$. The object is gradually moving into the evening sky but will probably be followed for at least another month. The deviations from the ephemeris given on p. 543 are still small showing that the parabolic elements computed by the writer from measures covering an interval of 17 days are substantially correct.

Dr. A. D. Maxwell has further refined the computation of the orbit by discussing the observational material from August 21 to September 21. He does not find any definite indication of a deviation from parabolic motion and gives the following elements:

$$\left.\begin{aligned} \omega &= 44^\circ\,05'\,35''.8 \\ \Omega &= 299\ \ 39\ \ 01.8 \\ i &= 66\ \ 19\ \ 32.2 \end{aligned}\right\} 1935.0$$

$$T = 1936,\ \text{May}\ 8.49923\ \text{U.T.}$$

$$q = 4.0731115$$

The exceptionally large perihelion distance is again confirmed. Figure 1 shows the path described in space by the comet from the time of discovery (1935 August 21) to the time of perihelion passage (1936 May 8). The small ellipse represents the yearly orbit of the earth around the sun. The section of a larger ellipse at the bottom shows part of the orbit of the planet Jupiter. The heavier curve is the parabolic path of the comet tipped by 66° relatively to the plane of the earth's orbit, the two planes intersecting along the line of nodes. It can be seen that shortly before the discovery the comet was only a small distance away from the orbit of Jupiter but the planet itself was then several astronomical units behind that point. The diagram illustrates the fact that the comet will be best situated for observation next summer and also that the visibility will be of long duration.

The ephemeris computed by Dr. Maxwell differs only slightly from the one given on p. 543 but he adds the following extension by means of which it will be possible to resume the observations after the conjunction with the sun in the middle of February next year:

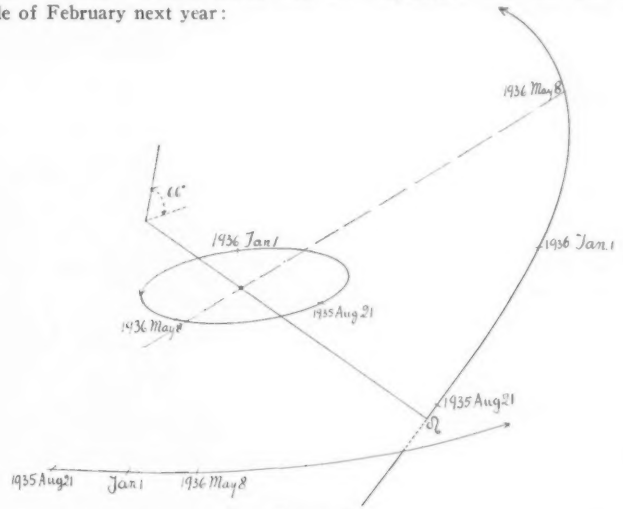


FIGURE 1.

THE ORBIT OF COMET 1935 *d* RELATIVE TO THE ORBITS OF THE EARTH AND JUPITER.

EPHEMERIS OF COMET 1935 *d*.

0^h U.T.		α	δ	—Distance from— Earth	Sun	Mag.
		h m s	° ′			
1936 Mar.	13	21 07 49	+10 56.4	4.834	4.102	14.5
	21	13 54	12 52.8			
	29	19 37	14 54.7	4.684	4.088	14.5
April	6	24 57	17 02.0			
	14	29 48	19 14.5	4.514	4.078	14.4
	22	34 07	21 32.1			
	30	37 49	23 54.3	4.334	4.074	14.3
May	8	40 46	26 20.6			
	16	42 56	28 50.2	4.156	4.074	14.2
	24	21 44 09	+31 22.0			

The brightness is computed under the assumption that the magnitude was 14.5 on October 20.

The other telescopic object under observation is PERIODIC COMET COMAS SOLA (1927 III) which is expected to reach 13^{M} in November. It has increased in brightness since it was recovered on August 12 by Jeffers at the Lick Observatory, and on October 7 a plate exposed by the writer showed that the tail had developed to a length of nearly 15′. The object may be found by means of the ephemeris given on p. 541.

PERIODIC COMET SCHWASSMANN-WACHMANN (1929 I) will shortly be observable again in the morning sky. It was followed from last December until February of this year but was in upper conjunction with the sun this summer. The following ephemeris by Rasmusen (Circ. 558 of the International Astronomical Union) depending on the observations to date will probably prove to be quite close to the truth:

0^{h} U.T.	α	δ
	h m s	° ′
1935 Nov. 2	11 22 10	+5 20.3
6	29 39	4 38.1
10	37 1	3 56.5
Nov. 14	11 44 16	+3 15.6

The object will probably remain quite faint.

From the orbit of COMET JACKSON (1935 *b*), which was observed last summer, Kanda and Simidu (Tokyo) have computed the approximate position of this object in the past two years. There is a very good chance that plates taken in the summer of 1934 will reveal the presence of the object at that time since the computed brightness then rose to 11^{M}.7 as seen from the following excerpt of the ephemeris (Circ. 557 of the International Astronomical Union).

	α	δ	
	h m	° ′	Mag.
1934 May 27	22 12.0	+28 26	12.5
June 28	21 29.0	30 22	
July 30	20 13.7	27 3	11.7
Aug. 31	19 2.8	16 57	
Oct. 2	18 27.4	+ 6 23	12.1

Williams Bay, Wisconsin, October 23, 1935.

Asteroid Notes

By HUGH S. RICE

At this time there seems to be but little to mention concerning activities of the minor planets. The two best objects for observation are 4 Vesta and 3 Juno, both of which assume magnitudes of about 7^{M}.3 in the middle of November. Plotted paths of these appeared in the June-July and the October numbers of this periodical.

One other asteroid not mentioned last time, 6 Hebe, is drawing near the earth and will come to opposition after the first of next year. (We refer to the brightest asteroids only, for there are hundreds of them of magnitudes 11 to 14, that are always to be found.) In November Hebe's magnitude will be 8.6 and this improves with time. The planet can be found near Procyon, and it reaches the eastern sta-

tionary point about November 24, after which it retrogrades. The *Astronomisches Rechen-Institut* at Berlin-Dahlem has published in its bulletins the ephemeris of this planet, and the following covers the November period:

EPHEMERIS OF 6 HEBE. EQUINOX 1925.

G.C.T.	α h m	δ ° ′
1935 Nov. 6.0	7 44.7	+6 44
14.0	7 48.4	6 23
22.0	7 50.1	6 10
30.0	7 49.8	6 7
Dec. 8.0	7 47.4	+6 16

American Museum of Natural History, New York, October 17, 1935.

Notes from Amateurs

An Exhibit of the Work of Amateurs

Similar to the exhibition of the work of the Amateur Astronomers of America, conducted in connection with the American Association for the Advancement of Science Convention in Pittsburgh last year, another will be held this year in St. Louis, Missouri. Any amateur wishing to submit pieces of equipment of his own manufacture, copies of celestial photographs made by himself, pictures of his telescope or observatory is asked to communicate with the writer.

LEO J. SCANLON.

Valley View Observatory, Observatory Post Office, Pittsburgh, Pa.

The Toledo Astronomical Society held its monthly meeting in the hall of the University of Toledo, Thursday, May 16. Mr. L. C. Peltier of Delphos, Ohio, gave an illustrated talk on general astronomy with emphasis on variable stars.

W. ALBERT HILTNER, *Secretary.*

Zodiacal Light Notes

By FRANKLIN W. SMITH

The morning Zodiacal Light was observed under very favorable conditions on October 5 between 4:00 and 4:20, E.S.T. It extended upward from Leo, through Cancer, and into Gemini where it was lost in the Milky Way. The northern edge passed approximately through λ Leonis, a few degrees north of γ Cancri, and through κ Geminorum. The southern edge passed between α Cancri and ζ Hydrae, south of ζ Cancri and toward ζ Geminorum. The axis of the light cone was therefore practically coincident with the ecliptic.

On September 30 at 11:00, E.S.T., the Gegenschein was seen in central Pisces. It appeared as a diffuse area bounded roughly by δ and 41 Piscium and by 20 Ceti. The Gegenschein may still be looked for during the next month but soon after that it will be too close to the Milky Way to be seen. It is completely overpowered by even the faint outer regions of the Milky Way and therefore it is lost to sight long before it reaches the boundaries of the Milky Way which are usually indicated on star maps.

407 Scott Avenue, Glenolden, Pennsylvania, October 17, 1935.

General Notes

Dr. Dinsmore Alter began his duties as Director of the Griffith Observatory and Planetarium, Los Angeles, in July. Dr. Alter is also Research Associate in Statistics at the California Institute of Technology. Dr. H. E. Crull is Assistant Director and Assistant Professor of Astronomy at the University of Southern California. Dr. E. C. Bower is lecturer at the Planetarium.

Amateur Astronomers Association.—The first meeting of the Amateur Astronomers Association for the year 1935-1936 was held in the large auditorium of the American Museum in New York City on Wednesday, October 9, at 8:15 P.M. Dr. Clyde Fisher spoke on the subject "The Hayden Planetarium," using both lantern slides and motion pictures.

The Rittenhouse Astronomical Society of Philadelphia held a meeting on Friday, October 11, at 8:15 P.M., in the Hall of The Franklin Institute, Parkway at Twentieth Street. The program consisted of an address on the subject "The Universe in Which We Live," illustrated, by The Rev. Dr. Paul A. McNally, S.J., Director, Georgetown University Observatory.

The Hayden Planetarium, a part of the American Museum of Natural History, New York City, has been completed and was opened to the public on October 3. The schedule of demonstrations includes two free demonstrations daily (except Saturday, Sunday, and holidays) for school children of New York City, and forty-one others, during the week for which there is an admission charge. Dr. Clyde Fisher is the director of the Planetarium and Dr. William H. Barton, Jr., is associated with him. Mr. Charles A. Federer, Jr., is one of the guest lecturers.

Note on an Anthelion

The anthelion seems to be a phenomenon rare enough to warrant the recording of descriptions by untrained observers. An apparition of the anthelion was seen by the writer on September 27, 1935, near Annapolis, Maryland, at 5:15 P.M., E.S.T.

The phenomenon consisted of a bright ill-defined spot from 2° to 3° in diameter, at the same altitude as the sun, but lying about 180° from the sun in azimuth. The spot exhibited spectral colors, arranged in vertical stripes, with the violet to the left. Blue was the most conspicuous tint, while red and violet could be seen clearly; no other color was certainly visible. The sky was nearly covered at the time by scattered clouds; in fact, the anthelion was projected on a cloud. The phenomenon faded and disappeared within a few minutes.

Pernter and Exner's *Meteorologische Optik,* 1910, p. 256, gives a brief account of the anthelion, in which it is stated that in only four cases has the anthelion been recorded as colored. R. W. Wood, in his *Physical Optics,* 3rd ed., p. 396, states that Pernter's explanation of the anthelion is not very satisfactory.

JOSEPH ASHBROOK.

P. O. No. 5, Johns Hopkins University, Baltimore, Maryland.